PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

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| In re Application of: William D. Morgan et al. | Group Art Unit: 1723 |
| Serial No.: 10/003,037 | Examiner: Krishnan S. Menon |
| Filed: November 2, 2001 | Atty. Dkt. No.: IAEC:006US/MTG |
| For: COVERING SYSTEMS AND VENTING METHODS | |

CERTIFICATE OF MAILING
37 C.F.R. § 1.8

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December 15, 2005 — Mark T. Garrett
Date

# APPEAL BRIEF

**Mail Stop - AF**
Commissioner of Patents
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Sir:

Appellants submit this Appeal Brief to the Board of Patent Appeals and Interferences in response to the May 17, 2005 Final Office Action. The Notice of Appeal filed by Applicants was stamped received by the Patent Office on November 21, 2005. If any fees are due with this filing and not covered by the enclosed check, the Commissioner is authorized to deduct the appropriate fees from Fulbright & Jaworski Deposit Account No.: 50-1212/IAEC:006US/MTG.

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## REAL PARTY IN INTEREST

The real parties in interest in this appeal are the joint assignees of the application, Agri Covers, Inc. and Industrial and Environmental Concepts, Inc.

## II. RELATED APPEALS AND INTERFERENCES

There are no related pending appeals or interferences.

## III. STATUS OF CLAIMS

Claims 1, 2, 5, 6, 9-15, 28, 29, 32 and 33 were under active examination at the time of the May 17, 2005 Final Office Action, were rejected and are the subject of the present appeal. A copy of the claims involved in this appeal without the amendments discussed in the next section is attached at the Claims Appendix 1, and with the amendments discussed in the next section at the Claims Appendix 2.

## IV. STATUS OF AMENDMENTS

An amendment was filed concurrently with the Notice of Appeal, canceling rejected claim 33 in order to place this application in better condition for appeal. Applicants have not received anything from the Office concerning the amendment. Applicants are filing an amendment concurrently with this Appeal Brief. In the amendment, the term "having" is added to the first element of claim 1 in order to correct its inadvertent omission from the claim 1 amendment of the March 22, 2005 response. The entry or non-entry of the "having" amendment will not affect the merits of this appeal.

## V. SUMMARY OF CLAIMED SUBJECT MATTER

Independent claim 1 is directed to a covering system comprising:

a first membrane a top surface and an opposing bottom surface;

a first flotation member coupled to the first membrane, wherein the first flotation member includes a first float and a first float compartment membrane having an inside surface and an opposing outside surface, and wherein the first float compartment membrane is coupled to the first membrane; and

a first plurality of gas-relief passageways positioned either:

within the first float compartment membrane and extending between the inside and opposing outside surfaces, or

within the first membrane, extending between the top and opposing bottom surfaces, and adjacent to the first flotation member;

wherein at least one of the gas-relief openings within the first plurality is structured so that gas flows unobstructed through it when the system is used.

Example support for the subject matter of claim 1 may be found in the Specification at page 3, lines 18-25 and in FIGS. 1 and 2, which show embodiments of a membrane 10 and a flotation member 20 coupled to membrane 10. Flotation member 20 includes float 22 and float compartment membrane 24, which is coupled to membrane 10 (*see, e.g.*, Specification at page 10, lines 14-26 and page 12, lines 19-25). These figures also show gas-relief passageways 26, which are positioned within membrane 10 in FIG. 1 and within float compartment membrane 24 in FIG. 2 (*see, e.g.*, Specification at page 12, lines 8-18).

Independent claim 28 is directed to a venting method comprising:

coupling a first membrane to a first flotation member, wherein the first flotation member includes a first float and a first float compartment membrane, and wherein the coupling includes coupling the first float compartment membrane to the first membrane, the first membrane having a top surface and an opposing bottom

surface, and the first float compartment membrane having an inside surface and an opposing outside surface;

forming gas-relief passageways either:

within the first float compartment membrane and extending between the inside and opposing outside surfaces, or

within the first membrane, extending between the top and opposing bottom surfaces, and adjacent to the first flotation member; and

elevating at least a portion of the first membrane:

so as to cause the first membrane to float when placed over a body containing some liquid; and

so that gas from the body is directly vented to atmosphere through at least one of the gas-relief passageways.

Example support for the subject matter of claim 28 may be found in the Specification at page 6, line 28 – page 7, line 7, in FIGS 1, 2 and 6, and at page 21, lines 1-10.

Independent claim 32 is directed to a method of venting gas from a body containing some liquid. The method comprises:

placing a covering system over the body, the covering system comprising:

a first membrane having an outer edge and a width;

a first flotation member coupled to the first membrane, wherein the first flotation member includes a first float and a first float compartment membrane, the first float has a width that is not more than twenty-five percent of the width of the first membrane and a first float compartment membrane, and the first float compartment membrane is coupled to the first membrane;

elevating portions of the first membrane above the body; and

positioning the covering system to allow gas from the body to vent directly to atmosphere around the outer edge of the first membrane.

Example support for the subject matter of claim 32 may be found in the Specification at page 7, lines 22-31 and page 26, lines 11-19.

## VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The issues for the Board's consideration are whether:

(1) claim 33 (incorrectly identified as claim 32 in the Final Office Action) is properly rejected as being indefinite for depending from a rejected claim;

(2) claims 1, 2, 5, 6, 9-15, 28, 29, 32 and 33 are properly rejected under 35 U.S.C. § 103(a) as being unpatentable over "applicant[s'] own admission of prior art" in view of U.S. Patent No. 4,503,988 to Gerber ("Gerber") (Ex. 1 of Evidence Appendix, and first entered by the Office in the May 17, 2005 Final Office Action);

(3) claims 1, 2, 5, 6, 11-13, 28, 29 and 32 are properly rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 4,438,863 to Wilson *et al.* ("Wilson"; Ex. 2 of Evidence Appendix, and first entered by the Office in the December 19, 2002 Office Action) in view of U.S. Patent No. 5,562,759 to Morgan *et al.* ("Morgan"; Ex. 3 of Evidence Appendix, and first noted by the Office in the December 19, 2002 Office Action and first entered by the Office in the May 17, 2005 Final Office Action); and

(4) claims 9, 10, 14, 15 and 33 are properly rejected under 35 U.S.C. § 103(a) as being unpatentable over Wilson in view of Morgan as applied to claim 1 and further in view of Reference C1 of the February 4, 2004 IDS ("C1"; Ex. 4 of the Evidence Appendix, and first entered by the Office in the March 19, 2004 Office Action).

## VII. ARGUMENT

### A. The Indefiniteness Rejection of Claim 33 Should Be Moot

The Office rejects claim 33 (mistakenly described as claim 32) as being indefinite for depending from a cancelled claim. This rejection will be moot if the November 17, 2005 claim amendment is entered.

### B. The Obviousness Rejection of Claims 1, 2, 5, 6, 9-15, 28, 29, 32 and 33

The Office makes statements in paragraph number one of the Final Office Action that must be addressed before the substance of the rejection is traversed. The Office states, "Instant claims are directed towards a device as shown in the references C4 and C2 as admitted by the applicant in the IDS of 2/17/04 as on sale or public use more than one year before the filing date of the application." Final Office Action at p. 3. Applicants do not acquiesce to this characterization about what the rejected claims are "directed to" because it is unclear to Applicants what the Office is asserting. The rejected claims are directed to what they recite. Reference C4 from the February 4, 2004 IDS ("C4"; Ex. 5 of the Evidence Appendix, and first entered by the Office in the March 19, 2004 Office Action) is admitted prior art, as is Reference C2 from the same IDS ("C2"; Ex. 6 of the Evidence Appendix, and first entered by the Office in the November 8, 2004 Office Action).

#### 1. Claim 1 Is Patentable Over the Asserted Combination

The Office has failed to carry its burden of establishing a *prima facie* case of obviousness with respect to claim 1 and its dependent claims because (1) the Office has not identified among its cited references a teaching or suggestion for the at least one claimed gas-relief passageway that is structured so that gas flows unobstructed through it when the claimed system is used, and (2) the Office has not identified an appropriate motivation to combine the asserted references and ignored contrary teachings in those references.

The Office relies on C2 as disclosing the claimed gas-relief passageways:

> Ref C2 (public use or on sale) teaches the relief vents in a device which has the floatation member and the float compartment membrane, but not the first membrane and the weights.

Final Office Action at p. 3. This is not correct. Claim 1 recites a first plurality of gas-relief passageways, and explains where they can be located and how at least one of them is structured:

> a first plurality of gas-relief passageways positioned either:
> within the first float compartment membrane and extending between the inside and opposing outside surfaces, or
> within the first membrane, extending between the top and opposing bottom surfaces, and adjacent to the first flotation member;
> wherein at least one of the gas-relief openings within the first plurality is structured so that gas flows unobstructed through it when the system is used.

Contrary to the Office's assertion, C2 fails to disclose or suggest a gas-relief passageway that is positioned within either the claimed first float compartment membrane or the claimed first membrane **and** that is structured so that gas flows unobstructed through it when the C2 system is used. The second page of reference C2 shows the different insulation cover modules being connected with fastening devices that extend through openings in the modules. However, those openings are structured so that they are obstructed with those fastening devices during use of the C2 cover system. Thus, they do not meet the claim limitation. Applicants specifically explained this in the current application:

> As used in this document, including the claims, a gas-relief passageway that is structured so that gas flows unobstructed through it when the cover or covering system of which it is a part is used means that the passageway is designed and created to be used without a fastener or other obstructing device within it. **In addition to flowing through the gas-relief passageways, gas may also flow through the openings through which fasteners 12 [see, e.g., FIGS. 1 and 2] are placed. This flow would not be unobstructed, however.**

Page 12, lines 13-18 (emphasis added). Thus, C2 does not teach or suggest the claimed at least one structured gas-relief passageway. For this reason alone, the Office has failed to sustain its burden and the rejection should be reversed.

Despite C2's failing, the Office asserts:

> It would be obvious to one of ordinary skill in the art at the time of the invention to use the teaching of C2 in the reference C4 (or the Gerber ref) for the gas relief vents to provide the gas or air relief to retain the membrane on the ... surface of water without lifting off due to accumulated gas underneath.

Final Office Action at p. 3. No such purported motivation (the need for the claimed gas-relief passageways to retain the membrane on the surface of the water without lifting off due to accumulated gas underneath) exists in any of the cited references. Moreover, the cited art teaches away from such a combination.

C2 teaches insulation modules that are linked together to be a "floating cover system which provides an affordable solution for insulation, odor containment and/or algae control on ponds and tanks [that] ... allows rainwater to pass between the individual casings and gases to escape." C2 at p. 2. The C2 modular cover (described as the LemTec™ Modular Cover System) **is not** a gas collection system.[1] In contrast, both C4 and Gerber **are** gas collection systems. It makes no sense to modify the gas collection systems of C4 and Gerber by the teachings (which are inadequate) of a modular insulating system (C2) that serves **no gas collection function.**

Michael A. Morgan, one of the inventors, explains in his March 22, 2005 declaration[2] that C4 was under negative pressure, which would be jeopardized if openings were formed in it:

> The cover system shown in reference C4 identified in the IDS is only a partial representation of the full cover system. The full cover system of C4 is similar to the cover systems disclosed in the Gerber patent (U.S. Patent No. 4,503,988). It

[1] C2 discloses the LemTec Gas Collection System on page 4, but it is not what the Office relies on.
[2] Ex. 7 to Evidence Appendix, and first introduced by Applicants with the March 22, 2005 Response.

> included a gas collection system for siphoning off gas that was collected under the cover. As a result, the C4 cover system was under negative pressure. **If openings were formed in the C4 cover, that negative pressure would be jeopardized, and the gas collection system could be rendered less effective or ineffective**.

Ex. 7 at ¶ 4 (emphasis added). Based on Mr. Morgan's testimony, C4 teaches away from the claimed first plurality of openings.

Gerber's teachings are similar to those of C4, as Mr. Morgan testified. Gerber teaches a gas collection system. *See* Ex. 1 at col. 1, lines 6-10 (invention relates to "a flexible cover for a reservoir for the purpose of **containing and collecting** gases") (emphasis added). Gerber never advocates allowing gas to escape. Instead, he teaches using vacuum pumps to facilitate gas recovery, *see id.* at col. 5, lines 30-33 and col. 8, lines 50-58, and points out that his gas collection cover system is "completely sealed" from the atmosphere. *Id.* at col. 11, lines 21-25. Furthermore, he consistently reports that there are no lift-off issues with his cover because of his purportedly novel system. *See id.* at col. 6, lines 28-34 (set up permits quick gas removal which lessens chance of lift-off). In fact, according to Gerber, the biaxial tension of his cover "prevents" lift-off:

> The fact that the entire cover is in biaxial tension, prevents the cover from rising above the surface more than a fraction of an inch or so. Further, the gas does not remain stationary beneath any one segment of the cover but moves steadily to the periphery or to a central manifold. This phenomenon, **prevents the cover from being lifted above the surface and driven by strong winds**. This prevents damage to the cover by tearing and further prevents the wind from moving the cover so as to interfere with the location of the surface water sumps or preventing the progression of gas to the gas manifolds.

*Id.* at col. 11, lines 42-53. These teachings make clear that **there is no "problem" to solve** in Gerber, and no logical reason to look to the non-gas collection system in C2. *See In re Nomiya*, 184 USPQ 607, 612-613 (CCPA 1975) (holding that it is improper to conclude that an invention

is obvious absent evidence that one of ordinary skill would have recognized that an underlying problem existed).

Another reason that Gerber teaches away from the asserted combination is that he stresses that oxygen from the atmosphere should not be mixed with the collected gas to avoid explosions:

> The present cover is completely sealed from the atmosphere so that where methane gas is being generated beneath the cover, oxygen from the atmosphere cannot mix with the methane to create a potentially explosive mixture of gases.

Ex. 1 at col. 11, lines 21-25.

For all of these reasons—the failing of C2 to teach or suggest what the Office asserts, the lack of motivation to apply C2's modular cover teachings to C4 or Gerber, and the teaching away in Gerber and C4 from the asserted combination—the rejection of claim 1 and its dependent claims should be reversed.

### 2. Claim 28 Is Patentable Over the Asserted Combination

Claim 28 is directed to a venting method that comprises:

> coupling a first membrane to a first flotation member, wherein the first flotation member includes a first float and a first float compartment membrane, and wherein the coupling includes coupling the first float compartment membrane to the first membrane, the first membrane having a top surface and an opposing bottom surface, and the first float compartment membrane having an inside surface and an opposing outside surface;
>
> forming gas-relief passageways either:
>
> > within the first float compartment membrane and extending between the inside and opposing outside surfaces, or
> >
> > within the first membrane, extending between the top and opposing bottom surfaces, and adjacent to the first flotation member; and
>
> elevating at least a portion of the first membrane:
>
> > so as to cause the first membrane to float when placed over a body containing some liquid; and

so that gas from the body is directly vented to atmosphere through at least one of the gas-relief passageways.

There is no motivation to provide either C4 or Gerber with the openings in the insulation modules of C2. C4 and Gerber teach away from such a modification for the reasons given above, which relate to C4 and Gerber being gas-**collection** (not gas-**escape**) systems. For those reasons, the Office failed to establish a *prima facie* case of obviousness, and the obviousness rejection of independent claim 28 and dependent claim 29 should be reversed.

### 3. Claim 32 Is Patentable Over the Asserted Combination

Claim 32 is directed to a venting method that comprises:

placing a covering system over the body, the covering system comprising:

a first membrane having an outer edge and a width;

a first flotation member coupled to the first membrane, wherein the first flotation member includes a first float and a first float compartment membrane, the first float has a width that is not more than twenty-five percent of the width of the first membrane and a first float compartment membrane, and the first float compartment membrane is coupled to the first membrane;

elevating portions of the first membrane above the body; and

positioning the covering system to allow gas from the body to vent directly to atmosphere around the outer edge of the first membrane.

The Office has not explained where in C2, C4 or Gerber the subject matter of this independent claim appears. *See* Final Office Action at pp. 2-4. More is needed to establish a proper rejection. *See* 37 C.F.R. § 104(c)(2); *see also* MPEP § 707.07(d) ("Where a claim is refused for any reason relating to the merits thereof it should be 'rejected' and the ground of rejection **fully and clearly stated** . . . . A plurality of claims should never be grouped together in a common rejection, unless that rejection is equally applicable to all claims in the group.")

(emphasis added). For this reason alone, the Office has failed to carry its burden, and the obviousness rejection of claim 32 should be reversed.

Moreover, neither C4 nor Gerber teach or suggest the step of "positioning the covering system to allow gas from the body to vent **directly to atmosphere around the outer edge of the first membrane**." As Mr. Morgan explains in his March 22, 2005 Declaration, C4 was a gas collection system that was anchored around its perimeter "so that gas would not escape around **its outer edge**." Ex. 7 at ¶¶ 4-5 (emphasis added). And Gerber explains that his cover "is **completely sealed** from the atmosphere so that where methane gas is being generated beneath the cover, oxygen from the atmosphere cannot mix with the methane to create a potentially explosive mixture of gases." Ex. 1 at col. 11, lines 21-25 (emphasis added). Thus, while C2 discloses panels that have outer edges around which gas could vent directly to atmosphere when only the insulation system from C2 is used, there is no motivation to combine that teaching from C2 with either C4 or Gerber. Instead, C4 and Gerber teach away from it because they are gas-tight.

Accordingly, the Office failed to establish a *prima facie* case of obviousness, and the obviousness rejection of independent claim 32 should be reversed.

#### 4. The Claim 33 Rejection Should Be Moot

The rejection of claim 33 will be moot if the Office enters the November 17, 2005 cancellation of claim 33.

Finally, the Office states on page 4 of the Final Office Action that "Applicants' declaration regarding the disclosure to Lemna Corporation is moot because, according to MPEP, public use or sale could be a 'secret sale or offer to sell.'" This is not a rejection, but Applicants want to make clear that they do not acquiesce to the Office's position that the event described in

the January 23, 2004 Declaration of Michael Morgan (Ex. 8 to Evidence Appendix, and first introduced by Applicants with the February 4, 2004 IDS) and repeated in the February 4, 2004 IDS constitutes an offer for sale or a public use.

### C. The Obviousness Rejection of Claims 1, 2, 5, 6, 11-13, 28, 29 and 32

The Office rejects these claims as being unpatentable over Wilson in view of Morgan. The Office has failed to carry its burden of establishing a *prima facie* case of obviousness with respect to claim 1 and its dependent claims for reasons similar to those discussed above: (1) the Office has not identified among its cited references a teaching or suggestion for the at least one claimed gas-relief passageway that is structured so that gas flows unobstructed through it when the claimed system is used, and (2) the Office has not identified an appropriate motivation to combine the asserted references and ignored contrary teachings in those references.

#### 1. Claim 1 Is Patentable Over the Asserted Combination

The Office admits that Wilson fails to teach the claimed first plurality of gas-relief passageways. Final Office Action at p. 5 (last paragraph). However, the Office asserts that "Morgan teaches such an arrangement wherein the ga[s] relief passage[ways] extend [from] the bottom surface to the top surface of the membrane in a pool cover with a gas collection system." *Id.* The Office asserts that it would have been obvious to combine Morgan's teachings with Wilson's because "the Morgan system is simpler and can be easily installed and removed without destroying the system (see Morgan col 1 lines 15-25 and 44-47)[.]" *Id.* at p. 6. The Office's reasoning fails because Morgan does not teach the at least one gas-relief passageway that is structured so that gas flows unobstructed through it when the system is used, and because Wilson teaches away from the asserted combination.

Morgan is directed to a gas collection system that is placed over insulated panels that are coupled together to insulate an anaerobic settling pond. The panels have openings in the form of eyelets 3, which are configured such that they are occupied by loops 2 when the panels are coupled together and they system is used. However, Applicants distinguished such eyelets as not qualifying as openings that are structured so that gas flows unobstructed through them when the system is used:

> As used in this document, including the claims, a gas-relief passageway that is structured so that gas flows unobstructed through it when the cover or covering system of which it is a part is used means that the passageway is designed and created to be used without a fastener or other obstructing device within it. **In addition to flowing through the gas-relief passageways, gas may also flow through the openings through which fasteners 12 [see, e.g., FIGS. 1 and 2] are placed. This flow would not be unobstructed, however.**

Specification at page 12, lines 13-18 (emphasis added). The Office must take this into account when interpreting the claims. *See In re Morris*, 127 F.3d 1048, 1054 (Fed. Cir. 1997) (PTO should take into account "whatever enlightenment by way of definitions or otherwise that may be afforded by the written description" in the specification).

Morgan explains that gas "can migrate through the seams between the panel units" (Ex. 3 at col. 1, lines 44-45), but such an arrangement does not meet the limitation of gas-relief openings positioned either within the first membrane or the first float compartment membrane. Morgan places gas collection pipes 4 in the channels formed by the junctions of adjacent panels, and then places a solid gas collection cover 11 over the pipes and the panels and secures the cover 11 "to provide a gas-tight seal." *Id.* at col. 2, lines 27-30. There is no motivation to place gas-relief passageways in gas-tight cover 11. Thus, Morgan does not disclose or suggest the claimed gas-relief passageway that is structured so that gas flows unobstructed through it when the system is

used. **For this reason alone**, the Office has failed to carry its burden and the rejection should be reversed.

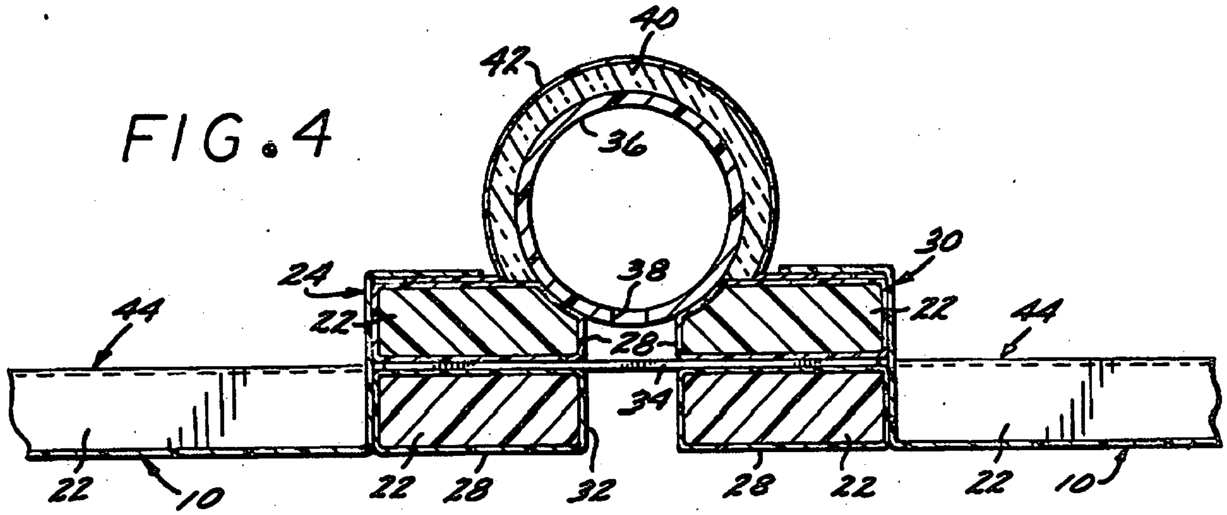
Moreover, there is no motivation to apply any of Morgan's teachings to those of Wilson. The Office seems to imply that Wilson should be modified to have insulation panels, like the insulation portion of the Morgan system when it states that the motivation for the combination relates to the Morgan system being simpler and easier to install. *See* Final Office Action at pp. 5-6. However, making that change to Wilson would **destroy** its gas-collection nature. Furthermore, just providing Wilson's cover 10 with gas-relief passageways as claimed will not make the Wilson system "simpler" or its installation "easier." Applicants simply do not understand the Office's purported motivation for the combination. In any event, Wilson teaches away from the purported combination for the following reasons.

The claimed first plurality of gas-relief passageways can be positioned either:

> within the first float compartment membrane and extending between the inside and opposing outside surfaces, or
>
> within the first membrane, extending between the top and bottom opposing surfaces, and adjacent to the first flotation member.

The Office points to Wilson's Figure 4, and asserts that the sleeve 28 is the claimed first float compartment membrane, and that cover 10 is the claimed first membrane. Two of the four sleeves 28 and the covers 10 from Wilson Figure 4 are highlighted below in red and green, respectively:

FIG. 4




Sleeve 28 is also shown in Wilson Figure 6. *See* Ex. 2.

It makes no sense to place gas-relief passageways within any of sleeves 28 as claimed. Wilson actually teaches away from it because Wilson explains that the sleeves 28 are designed to protect and preserve the structural integrity of the floats 22:

> Each flotation block 22 is made of a buoyant material, such as closed cell plastic foam material or the like, and the purpose of the sleeve 28 is to protect such material and preserve the structural integrity of the block.

Ex. 2 at col. 3, lines 64-67.

This leaves cover 10 as the only material that is arguably suitable for having the claimed gas-relief passageways. However, Wilson teaches away from placing such passageways in cover 10. Wilson is directed to a cover system for the collection of large volumes of gas. *Id.* at col. 1, lines 58-62. The flotation strings that are used to prop up the cover 10 and create gas passageways that feed a main gas collection conduit 36 terminate inside the perimeter of the container 12 holding the covered liquid. Ex. 2 at col. 4, lines 47-51. This is done so that excess cover material can sink into the liquid to create a sump 16 where rainwater can be collected and siphoned off. *Id.* at col. 6, lines 49-58. Outside the sump 16, the periphery of the cover 10 is attached in fluid-tight relationship to the upper part of the container 12. *Id.* at col. 3, lines 21-25;

FIG. 2. Gas that collects outside the sump 16 can be vented at openings 66[1] or using vent pipes 64. Ex. 2 at col. 5, lines 26-32. However, all the gas inside the sump is designed to be collected in main gas collection conduit 36 and vented away to "a collection tank, scrubber, burner of other apparatus 56 for treating or disposing of the collected gases." *Id.* at col. 5, lines 8-15.

In light of Wilson's teachings, it makes no sense to attempt to combine the teachings of the non-gas collection insulating panel portion of the Morgan system with Wilson's system, which is devoted to gas collection. *See* Ex. 7 at ¶¶ 7-9. Allowing gas to escape from beneath the sump-surrounded portion of Wilson would defeat the purpose of Wilson and render it unsatisfactory for its intended purpose: gas collection. MPEP § 2143.01 ("If [the] proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification.") (citing *In re Gordon*, 733 F.2d 900 (Fed. Cir. 1984)). Furthermore, rain water could pass through any openings in Wilson's cover 10 and into the "dirty" liquid it covers. This is undesirable because increases to the volume of "dirty" liquid should be avoided. *See* Ex. 7 at ¶¶ 7-8.

For these additional reasons, the Office has failed to carry its burden because Wilson teaches away from the asserted combination, and the rejection of claim 1 and its dependent claims should be reversed.

### 2. Claim 28 Is Patentable Over the Asserted Combination

The Office asserts that Wilson:

> teaches a method for venting pool with providing a membrane pool cover having one or more membranes and float supports sealed in the membrane, and with a series of gas vent passages as in instant claims (see figures 1-10 and col 3 line 3-col 5 line 58, and the rejection of claims 1 and 16 for more details). Wilson also

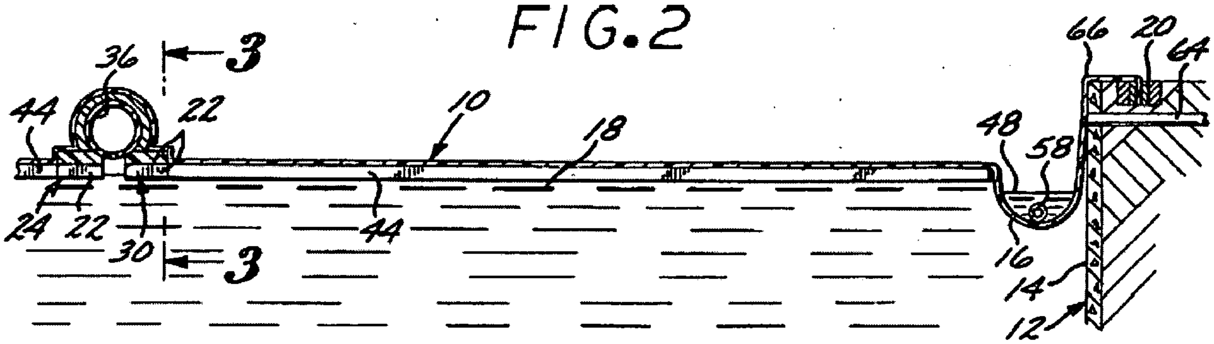
[1] Openings 66 **are not** within and extending through a portion of cover 10 that is **adjacent** to a flotation member.

> teaches venting directly to the atmosphere in col 5lines 29-32; and vent 66 of fig 2. Thus Wilson anticipates direct venting through vent 66 in fig 2. If not, it would be obvious to one of ordinary skill in the art at the time of invention that the gas collected through the gas pipe 36 could be directly vented to the atmosphere, if separate collection of the gases is deemed unnecessary.

Final Office Action at p. 6. The Office asserts that Wilson differs from claim 28 "by amendment of 3/28/05 makes the gas-relief passages as extending from the top and bottom surfaces of the membrane." *Id.* The Office's asserted motivation for combining Morgan's teachings with those of Wilson is "the Morgan system is simpler and can be easily installed and removed without destroying the system."

The direct venting the Office references occurs through vent openings 66 (Ex. 2 at col. 5, lines 29-32), one of which is referenced in Wilson Figure 2:

FIG.2




Those vent openings are positioned in cover 10, but not within a portion of cover 10 that is **adjacent** to a flotation member (as claimed). Applicants have explained above why it would not make sense to position the claimed gas-relief passageways within any of sleeves 28. Furthermore, Applicants have explained above why Wilson teaches away from combining any of Morgan's teachings with Wilson's cover 10. Those reasons apply with equal force here, and the obviousness rejection of independent claim 28 and dependent claim 29 should be reversed.

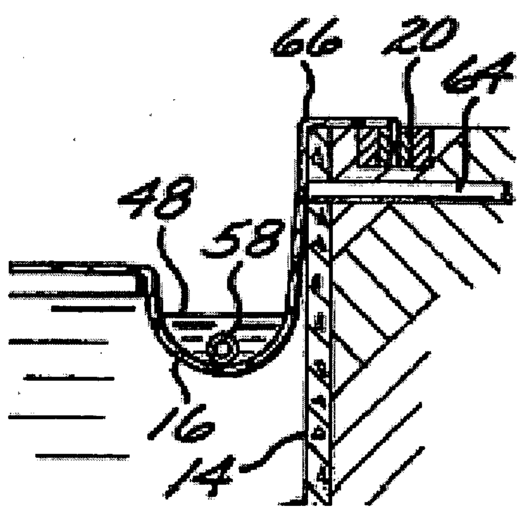
### 3. Claim 32 Is Patentable Over the Asserted Combination

Claim 32 recites, in relevant part, positioning the covering system to allow gas from the body to vent directly to atmosphere **around the outer edge of the first membrane**. The Office does not address the claimed positioning in its rejection, and Wilson fails to disclose or suggest it. The periphery of Wilson's cover 10 is attached in **fluid-tight relationship** to the upper part of the container 12:

> The peripheral or free edges of the cover 10 are attached in fluid-tight relationship to the upper part of the container 12 by any suitable, peripherally continuous anchorage apparatus 20, as will be apparent to those skilled in the art.

Ex. 2 at col. 3, lines 21-25; FIG. 2. Gas that collects outside the sump 16 can be vented at openings 66 or using vent pipes 64. *Id.* at col. 5, lines 26-32. However, there is no disclosure or suggestion in Wilson for allowing gas to escape **around the outer edge** of cover 10.

While the insulating, non-gas collection portion of the Morgan system discloses panels that have outer edges around which gas could vent, that venting **is not directly to atmosphere** because overlying, gas-tight cover 11 is in the way. Even if it were proper to ignore gas-tight cover 11, there would still be no motivation to combine any teachings of Morgan with Wilson because Wilson teaches anchoring the outer edge of cover 10 (as shown below in Wilson Figure 2):



For these reasons, the Office has failed to carry its burden of establishing a *prima facie* case of obviousness, and the rejection of claim 32 should be reversed.

### D. The Obviousness Rejection of Claims 9, 10, 14, 15 and 33

The Office rejects these claims as obvious over Wilson in view of Morgan as applied to claim 1 and further in view of C1. The rejection should be reversed.

#### 1. Claims 9, 10, 14 and 15 Are Patentable Over the Asserted Combination

Claims 9, 10, 14 and 15 depend from claim 1, and are patentable over Wilson in view of Morgan for the reasons provided above in Section VII.C.1. C1 does not cure the deficiency of the asserted combination of Wilson in view of Morgan. Accordingly, the rejection of these dependent claims should be reversed.

#### 2. The Claim 33 Rejection Should Be Moot

The rejection of claim 33 will be moot if the Office enters the November 17, 2005 cancellation of claim 33.

## VIII. CONCLUSION

For all of these reasons, the rejections of the appealed claims should be reversed. Please date stamp and return the enclosed postcard to evidence receipt of this document.

Respectfully submitted,

Mark T. Garrett
Reg. No. 44,699
Attorney for Applicants

FULBRIGHT & JAWORSKI
600 Congress Avenue, Suite 2400
Austin, Texas 78701
(512) 536-3031
Date: December 15, 2005

# Claims Appendix 1

1. A covering system comprising:

a first membrane a top surface and an opposing bottom surface;

a first flotation member coupled to the first membrane, wherein the first flotation member includes a first float and a first float compartment membrane having an inside surface and an opposing outside surface, and wherein the first float compartment membrane is coupled to the first membrane; and

a first plurality of gas-relief passageways positioned either:

within the first float compartment membrane and extending between the inside and opposing outside surfaces, or

within the first membrane, extending between the top and opposing bottom surfaces, and adjacent to the first flotation member;

wherein at least one of the gas-relief openings within the first plurality is structured so that gas flows unobstructed through it when the system is used.

2. The covering system of claim 1, wherein the first float is sealed in the first float compartment membrane.

5. The covering system of claim 1, wherein the first float compartment membrane is coupled to either an upper surface or a lower surface of the first membrane, and wherein the first float is positioned between the first membrane and the first float compartment membrane.

6. The covering system of claim 1, wherein the first flotation member is coupled to the first membrane so as to elevate the first plurality of gas-relief passageways above at least a portion of the first membrane when the system is used.

9. The covering system of claim 1, further comprising:

a second flotation member coupled to the first membrane, wherein the second flotation member includes a second float and a second float compartment membrane, the second float compartment membrane is coupled to the first membrane, and the second flotation member is spaced apart from the first flotation member; and

a first elongated weight positioned on an upper surface of the first membrane and between the first and second flotation members.

10. The covering system of claim 9, further comprising:

a second elongated weight positioned on an upper surface of the first membrane at an angle to either the first flotation member, the second flotation member, or the first elongated weight.

11. The covering system of claim 1, further comprising:

an anchor system coupled to an edge of the first membrane, the anchor system comprising:

a weighted member extending along and coupled to at least a portion of the edge of the first membrane.

12. The covering system of claim 11, wherein the anchor system further comprises a connector coupled to the edge of the first membrane.

13. The covering system of claim 12, wherein the connector includes a sleeve.

14. The covering system of claim 1, further comprising:

a service opening positioned within the first membrane, the service opening being defined by a service opening edge and being spaced apart from the first flotation member and the first plurality of openings;

a second flotation member coupled to the first membrane so as to elevate the service opening edge above a body containing some liquid when the system is used; and

a service opening membrane coupled to the service opening edge.

15. The covering system of claim 14, further comprising:

a service opening weight coupled to the service opening membrane and spaced apart from the service opening edge.

28. A venting method comprising:

coupling a first membrane to a first flotation member, wherein the first flotation member includes a first float and a first float compartment membrane, and wherein the coupling includes coupling the first float compartment membrane to the first membrane, the first membrane having a top surface and an opposing bottom

surface, and the first float compartment membrane having an inside surface and an opposing outside surface;

forming gas-relief passageways either:

within the first float compartment membrane and extending between the inside and opposing outside surfaces, or

within the first membrane, extending between the top and opposing bottom surfaces, and adjacent to the first flotation member; and

elevating at least a portion of the first membrane:

so as to cause the first membrane to float when placed over a body containing some liquid; and

so that gas from the body is directly vented to atmosphere through at least one of the gas-relief passageways.

29. The venting method of claim 28, wherein the coupling includes welding the first float compartment membrane to the first membrane.

32. A method of venting gas from a body containing some liquid, comprising:

placing a covering system over the body, the covering system comprising:

a first membrane having an outer edge and a width;

a first flotation member coupled to the first membrane, wherein the first flotation member includes a first float and a first float compartment membrane, the first float has a width that is not more than twenty-five percent of the

width of the first membrane and a first float compartment membrane, and the first float compartment membrane is coupled to the first membrane;

elevating portions of the first membrane above the body; and

positioning the covering system to allow gas from the body to vent directly to atmosphere around the outer edge of the first membrane.

33. The covering system of claim 16, further comprising:

a second float coupled to the first membrane, the second float being spaced apart from the first float; and

a first elongated weight positioned on an upper surface of the first membrane and between the first and second floats.

## Claims Appendix 2

1. A covering system comprising:

a first membrane having a top surface and an opposing bottom surface;

a first flotation member coupled to the first membrane, wherein the first flotation member includes a first float and a first float compartment membrane having an inside surface and an opposing outside surface, and wherein the first float compartment membrane is coupled to the first membrane; and

a first plurality of gas-relief passageways positioned either:

within the first float compartment membrane and extending between the inside and opposing outside surfaces, or

within the first membrane, extending between the top and opposing bottom surfaces, and adjacent to the first flotation member;

wherein at least one of the gas-relief openings within the first plurality is structured so that gas flows unobstructed through it when the system is used.

2. The covering system of claim 1, wherein the first float is sealed in the first float compartment membrane.

5. The covering system of claim 1, wherein the first float compartment membrane is coupled to either an upper surface or a lower surface of the first membrane, and wherein the first float is positioned between the first membrane and the first float compartment membrane.

6. The covering system of claim 1, wherein the first flotation member is coupled to the first membrane so as to elevate the first plurality of gas-relief passageways above at least a portion of the first membrane when the system is used.

9. The covering system of claim 1, further comprising:

a second flotation member coupled to the first membrane, wherein the second flotation member includes a second float and a second float compartment membrane, the second float compartment membrane is coupled to the first membrane, and the second flotation member is spaced apart from the first flotation member; and

a first elongated weight positioned on an upper surface of the first membrane and between the first and second flotation members.

10. The covering system of claim 9, further comprising:

a second elongated weight positioned on an upper surface of the first membrane at an angle to either the first flotation member, the second flotation member, or the first elongated weight.

11. The covering system of claim 1, further comprising:

an anchor system coupled to an edge of the first membrane, the anchor system comprising:

a weighted member extending along and coupled to at least a portion of the edge of the first membrane.

12. The covering system of claim 11, wherein the anchor system further comprises a connector coupled to the edge of the first membrane.

13. The covering system of claim 12, wherein the connector includes a sleeve.

14. The covering system of claim 1, further comprising:

a service opening positioned within the first membrane, the service opening being defined by a service opening edge and being spaced apart from the first flotation member and the first plurality of openings;

a second flotation member coupled to the first membrane so as to elevate the service opening edge above a body containing some liquid when the system is used; and

a service opening membrane coupled to the service opening edge.

15. The covering system of claim 14, further comprising:

a service opening weight coupled to the service opening membrane and spaced apart from the service opening edge.

28. A venting method comprising:

coupling a first membrane to a first flotation member, wherein the first flotation member includes a first float and a first float compartment membrane, and wherein the coupling includes coupling the first float compartment membrane to the first membrane, the first membrane having a top surface and an opposing bottom

surface, and the first float compartment membrane having an inside surface and an opposing outside surface;

forming gas-relief passageways either:

within the first float compartment membrane and extending between the inside and opposing outside surfaces, or

within the first membrane, extending between the top and opposing bottom surfaces, and adjacent to the first flotation member; and

elevating at least a portion of the first membrane:

so as to cause the first membrane to float when placed over a body containing some liquid; and

so that gas from the body is directly vented to atmosphere through at least one of the gas-relief passageways.

29. The venting method of claim 28, wherein the coupling includes welding the first float compartment membrane to the first membrane.

32. A method of venting gas from a body containing some liquid, comprising:

placing a covering system over the body, the covering system comprising:

a first membrane having an outer edge and a width;

a first flotation member coupled to the first membrane, wherein the first flotation member includes a first float and a first float compartment membrane, the first float has a width that is not more than twenty-five percent of the

width of the first membrane and a first float compartment membrane, and the first float compartment membrane is coupled to the first membrane;

elevating portions of the first membrane above the body; and

positioning the covering system to allow gas from the body to vent directly to atmosphere around the outer edge of the first membrane.

## **Evidence Appendix**

Copies of the following exhibits are provided:

Ex. 1 – U.S. Patent No. 4,503,988 ("Gerber"). A PTO copy and an HTML version (no figures) of Gerber are provided, and the beginning and end of columns 3 and 4 are noted on the HTML version because the PTO copy lacks the front page and the page containing columns 3 and 4;

Ex. 2 – U.S. Patent No. 4,438,863 ("Wilson");

Ex. 3 – U.S. Patent No. 5,562,759 ("Morgan");

Ex. 4 – Reference C1 from February 4, 2004 IDS;

Ex. 5 – Reference C4 from February 4, 2004 IDS;

Ex. 6 – Reference C2 from February 4, 2004 IDS;

Ex. 7 – March 22, 2005 Second Declaration of Michael A. Morgan;

Ex. 8 – February 4, 2004 Declaration of Michael A. Morgan.

## Related Proceedings Appendix

None.

# EXHIBIT 1

**United States Patent** ***4,503,988***
**Gerber** **March 12, 1985**

# Gas collecting tensioned reservoir cover

**Abstract**

A flexible cover for placement upon the fluid surface of an open reservoir. A plurality of elongated weights form elongated sumps in the cover for the collection of surface water. All horizontal portions of the cover and the sump walls are in biaxial tension. A perimeter gas manifold at the periphery of the reservoir receives gas generated beneath the cover. The flow of gas to the periphery is enhanced by varying the linear weight of the sump weights or by placing small weights on the horizontal cover portions. Floats may also be placed beneath the cover to collect the gas. Different weight cover portions are also used to enhance gas migration to gas manifolds. The cover may also be formed with floats adjacent the sumps to facilitate the removal of gas driven against the float by ambient winds.

Inventors: **Gerber; Dennis H.** (Los Gatos, CA)
Assignee: **Burke Industries, Inc.** (San Jose, CA)
Appl. No.: **651665**
Filed: **September 17, 1984**

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|---|---|
| **Current U.S. Class:** | **220/219**; 220/216 |
| **Intern'l Class:** | B65D 088/38 |
| **Field of Search:** | 220/216,219 |

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*Primary Examiner:* Pollard; Steven M.
*Attorney, Agent or Firm:* Cypher; James R.

***Claims***

I claim:

1. A tensioned reservoir cover for placement upon the fluid surface of an open reservoir comprising:

a. a flexible cover member of substantially fluid impervious material of sufficient area to cover the surface of said reservoir;

b. means connecting the perimeter of said cover member to the perimeter of said reservoir;

c. gas collecting means located at the periphery of said reservoir;

d. sump weighting means positioned with respect to said cover member at pre-selected positions;

e. a plurality of cover sump portions formed in said cover by said weighting means, each of said sump portions being defined, narrow, elongated and interconnected and having generally vertical sidewalls in tension and having a selected location for all working fill levels of said reservoir;

f. a plurality of generally horizontal cover portions formed in said cover by said weighting means, each of said horizontal cover portions having a selected geometric shape and positioned at a selected location for all working fill levels of said reservoir and all of said horizontal cover portions are in tension in at least two different horizontal directions of sufficient magnitude to permit workmen to traverse all portions of said horizontal cover portions for all working fill levels with said horizontal cover remaining substantially planar in sustaining the weight of the workmen;

g. said horizontal cover portions are bordered by said reservoir perimeter and said sump portions and cover substantially all of the surface of said reservoir for all working fluid level conditions; and

h. said horizontal cover portions bordering said reservoir perimeter are in gaseous communication with

said gas collection means.

2. A tensioned reservoir cover as described in claim 1 comprising:

a. said sump weighting means includes a plurality of elongated sump weight members which extend from proximal locations bordering the perimeter of said reservoir and terminate at distal locations distant from the perimeter of said reservoir; and

b. each of said sump weight members which extend from proximal locations bordering the perimeter of said reservoir is constructed having a progressively increasing linear weight in direct proportion to the distance from said proximal location at the perimeter of said reservoir.

3. A tensioned reservoir cover as described in claim 1 comprising:

a. a plurality of surface weight means having a linear weight substantially less than the linear weight of said sump weighting means;

b. said surface weight means including a plurality of elongated surface weight members depressing portions of said horizontal cover portions along selected lines extending from proximal locations bordering the perimeter of said reservoir and terminating at distal locations distant from the perimeter of said reservoir;

c. said surface weight members follow generally straight lines intersecting the perimeter of said reservoir at generally right angles; and

d. path means delineated by said surface weight members for enhancing the migration of gas along said path means to said gas collection means bordering the perimeter of said reservoir.

4. A tensioned reservoir cover as described in claim 3 comprising:

a. said surface weight member are constructed having a progressively increasing linear weight in direct proportion to the distance from said proximal location at the perimeter of said reservoir.

5. A tensioned reservoir cover as described in claim 1 comprising:

a. said horizontal cover portions formed in said cover between said perimeter of said reservoir and said sumps distant from said perimeter are sectioned into inner portions and peripheral portions;

b. said inner portions are formed from a cover material having a weight per square foot greater than the weight per square foot of the cover material forming said peripheral portions; and

c. said differential in cover weight enhances the migration of gas formed beneath said cover to the perimeter of said cover.

6. A tensioned reservoir cover as described in claim 1 comprising:

a. weighting means gradually increasing the weight of said horizontal cover portions in direct proportion to the distance from said gas collection means.

7. A tensioned cover as described in claim 6 wherein:

a. said weighting means consists of a sand and a binding material spread upon said cover in a gradually increasing thickness.

8. A tensioned reservoir cover as described in claim 1 comprising:

a. a plurality of elongated topside float meabers attached to portions of the upper surface of said horizontal cover portions spaced from one another and extending from proximal locations bordering the perimeter of said reservoir and terminating at distal locations distant from the perimeter of said reservoir;

b. said elongated topside float members follow generally straight lines intersecting the perimeter of said reservoir at generally right angles; and

c. path means delineated by said elongated topside float members for enhancing the migration of gas along said paths to said gas collection means bordering said reservoir perimeter.

9. A tensioned reservoir cover as described in claim 1 comprising:

a. a plurality of elongated cover lifting float members having upper surfaces attached to the underside of portions of said horizontal cover portions spaced from one another and extending from proximal locations bordering the perimeter of said reservoir and terminating at distal locations distant from the perimeter of said reservoir;

b. said cover lifting float members having side member portions spaced above said fluid surface and spaced from the underside of said cover;

c. said cover lifting float members follow generally straight lines intersecting the perimeter of said reservoir at generally right angles;

d. said cover lifting float members raise said cover portions attached to said upper surfaces above the fluid surface of said reservoir and said sump weighting means tension said cover holding said cover away from said side member portions of said cover lifting float members providing a constantly open passageway for passage of gas from the underside of said horizontal cover portions to said gas collection means bordering said reservoir perimeter.

10. A tensioned reservoir cover as described in claim 9 comprising:

a. a plurality of surface weight means having a linear weight substantially less than the linear weight of said sump weighting means;

b. said surface weight means including a plurality of elongated surface weight members depressing portions of said horizontal cover portions along selected lines extending from proximal locations bordering the perimeter of said reservoir and terminating at distal locations distant from the perimeter of said reservoir and located between and generally parallel to pairs of said cover lifting float members; and

c. said surface weight means cooperating with said sump weighting means, urges gas to migrate toward said open passage ways adjacent said cover lifting float members.

11. A tensioned reservoir cover as described in claim 9 comprising:

a. said sump weighting means includes a plurality of elongated sump weight members which extend from proximal locations bordering the perimeter of said reservoir and terminate at distal locations distant from the perimeter of said reservoir;

b. each of said sump weight members which extend from proximal locations bordering the perimeter of said reservoir is constructed having a progressively decreasing linear weight in direct proportion to the distance from said proximal location at the perimeter of said reservoir; and

c. said sump weight members having said decreasing linear weight construction cause said cross sectional area of said constantly open passageway adjacent said cover lifting float members to be progressively smaller in direct proportion to the distance from the perimeter of said reservoir.

12. A tensioned reservoir cover as described in claim 1 comprising:

a. said weight means is positioned on said cover to form a central sump and a central horizontal cover portion;

b. said weighting means is positioned on said cover forming a plurality of lines of segmented weights connecting each corner of said reservoir to said central sump; and

c. central gas manifold means operatively connecting said gas collection means and said central horizontal cover portion.

13. A tensioned reservoir cover as described in claim 12 comprising:

a. said central area of said cover is formed with an inner portion surrounded by an outer portion;

b. said inner portion of said cover is formed from a cover material having a weight per square foot less than the weight per square foot of the cover material forming said outer portion; and

c. said differential in cover weight enhances the migration of gas formed beneath said cover inwardly of said central sump to said inner portion of said central cover area.

14. A tensioned reservoir cover as described in claim 13 comprising:

a. said horizontal cover portions formed in said cover between said central sump and said perimeter of said reservoir are formed with an inner peripheral portion bordering said central sump and an outer peripheral portion bordering said perimeter of said reservoir;

b. said inner peripheral portion of said cover bordering said central sump is formed from a cover material having a weight per square foot greater than the weight per square foot of the cover material forming said outer peripheral portion bordering said perimeter of said reservoir; and

c. said differential in cover weight enhances the migration of gas formed beneath said cover outwardly of said central sump to said perimeter of said reservoir.

15. A tensioned reservoir cover as described in claim 12 comprising:

a. a plurality of surface weight means having a linear weight substantially less than the linear weight of said sump weighting means; and

b. said surface weight means including a plurality of elongated surface weight members depressing portions of said central horizontal cover portion along selected lines extending from proximal locations bordering the perimeter of said central sump and distal locations bordering said central gas manifold means.

16. A tensioned reservoir cover as described in claim 12 comprising:

a. a plurality of elongated topside float members attached to portions of the upper surface of said horizontal cover portions spaced from one another and extending from proximal locations bordering the perimeter of said reservoir and terminating at distal locations bordering said central sump;

b. said elongated topside float members follow generally straight lines intersecting the perimeter of said reservoir at generally right angles;

c. path means delineated by said elongated topside float members for enhancing the migration of gas along said paths to said gas collection means bordering said reservoir perimeter;

d. said central gas manifold means includes an elongated central float member attached to the underside of said cover;

e. a plurality of elongated central topside float members attached to portions of the upper surface of said central horizontal cover portion spaced from one another and extending proximal locations bordering said central sump and terminating at distal locations adjacent said central float member;

f. said elongated central topside float members follow generally straight lines intersecting portions of said central sump and said elongated central float member at generally right angles; and

g. path means delineated by said central topside float members for enhancing the mirgration of gas along said paths to said central gas manifold;

17. A tensioned reservoir cover as described in claim 12 comprising:

a. said central gas manifold means includes an elongated central float member attached to the underside of said cover;

b. a plurality of elongated cover lifting float members having upper surfaces attached to the underside of portions of said central horizontal cover portion spaced from one another and extending from proximal locations bordering said central sump and terminating at distal locations adjacent said central float member;

c. said cover lifting float members having side member portions spaced above said fluid surface and spaced from the underside of said cover;

d. said cover lifting float members follow generally straight lines intersecting portions of said central sump at generally right angles;

e. said cover lifting float members raise said cover portions attached to said upper surfaces above the fluid surface of said reservoir and said sump weighting means tension said cover holding said cover away from said side member portions of said cover lifting float members providing a constantly open passageway for passage of gas from the underside of said horizontal cover portions to said central gas collection means.

18. A tensioned reservoir cover as described in claim 1 comprising:

a. said cover member consists of a first ply formed from a material resistant to the liquid and solid materials filling said reservoir; and

b. said cover member consists of a second ply formed from a material resistant to the effects of climate layered on top of said first ply.

19. A tensioned reservoir cover as described in claim 1 comprising:

a. a plurality of cover lifting sump edge float members having upper surfaces attached to the underside of portions of said horizontal cover portions located closely adjacent a side of said cover sump portions;

b. said cover lifting sump edge float members having side member portions spaced above said fluid surface and spaced from the underside of said cover;

c. said cover lifting sump edge float members raise said cover portions attached to said upper surface above the fluid surface of said reservoir and said sump weighting means tension said cover away from said side member portions of said cover lifting sump edge float members providing a constantly open passageway for passage of gas from the underside of said horizontal cover portions to said gas collection means;

d. water means permitting flow of surface water from said horizontal cover portions to said cover sump portions; and

e. gas passage means connecting said open passageways adjacent said cover lifting sump edge float members and said gas collecting means.

## *Description*

BACKGROUND OF THE INVENTION

This invention relates to a flexible cover for a reservoir for the purpose of containing and collecting gases generated by or charged in or through the liquid and/or solid material contained in the reservoir and for draining surface water to collection sumps.

This application is co-pending with my application entitled Reservoir Cover with Tensioned Plates, Ser. No. 06/425,556, base issue paid Aug. 2, 1984 which was a continuation-in-part of my application entitled Tensioned Plate Reservoir Cover, Ser. No. 06/332,972 filed Dec. 21, 1981.

Early efforts in containing and venting but not collecting gases occurred in the petroleum industry where gases had to be vented from the stored hydrocarbons to prevent explosions. Examples of such teachings are found in Holmes, U.S. Pat. No. 1,136,230 (1915), Huff, U.S. Pat. No. 1,513,043, (1924), Griffin, U.S. Pat. No. 1,777,560, (1930) and U.S. Pat. No. 2,007,193, (1935), Moyer, U.S. Pat. No. 2,601,317, (1952) and Champagnat, U.S. Pat. No. 2,867,347 (1959). All of these patents are specific to cylindrical steel tanks and the covers are constructed with a plurality of floating pontoon or boat-like segments and skirt members to seal the sides of the pontoons and the smooth cylindrical vertical sides of the tank. Since the floats or covers of the prior art are rigid, the gas beneath the heavy rigid cover is simply under

pressure and is vented at random points on the cover by vent pipes or drawn off by a vacuum pump. Rainwater in such oil storage tanks is either shed by steel roofs or collected in low points in the floating pontoons.

Daniels, U.S. Pat. No. 3,474,931, (1969) teaches a flexible blanket but the blanket is held above the surface of the liquid by floats.

Kays, U.S. Pat. No. 3,980,199 presents an attempted solution to collect gas from a reservoir by placing a flexible cover directly on the surface of the liquid. The Kays cover is not in tension but rather lays loosely on the liquid surface and in practice would develop random folds which would prevent the flow of gas beneath the cover to the gas collecting means and would at the same time prevent the free flow of rainwater to surface water collection points on the upper surface of the cover. It is believed the Kays patent illustrated in FIGS. 1-3 will not operate as disclosed and the second form illustrated in FIGS. 4-7 is also inoperative.

BRIEF SUMMARY OF THE INVENTION

The gist of the present invention is the use of a cover as taught in my co-pending application entitled RESERVOIR COVER WITH TENSIONED PLATES filed Sept. 28, 1982, Ser. No. 06/425,556 (Issue Fee paid Aug. 2, 1984) in combination with a perimeter gas collection system, or a central manifold gas collection system.

The pending application illustrates a plurality of reservoirs having different geometric shapes. The pending application also shows covers for slope sided reservoirs as well as vertical sided reservoirs. All of the covers shown in the pending application show covers in which all horizontal portions are in tension. All of the covers either have panels, all of which are attached to the perimeter or have panels which attach to the perimeter and include one or more central panels. For purposes of this application only the slope sided rectangular reservoir is shown but it is to be understood that all of the reservoirs shown in the pending application may be used with either of the two manifold systems illustrated in this application. The present application will collect surface water which falls upon the cover in the form of rain in deep sumps formed in the cover by weights placed upon the cover in the same manner as the co-pending application and will also collect gas generated or introduced beneath the cover in such a way that it can be easily carried off in a manifold system. The flow of the gas to the perimeter of the reservoir or to a collection point on a central panel may be enhanced by placing elongated weights on the surface of the cover. These surface weights are lighter than the weights used to form the water sumps and remain on the surface rather than forming additional sumps.

Another system for enhancing the migration of gas to the perimeter or to the collectidn point in the central panels is to place a plurality of elongated floats under the tensioned panel cover portions creating a gas opening parallel to and on both sides of the float. The weights in the sumps maintain the cover in tension which holds the cover away from the sides of the sump and keeps the gas opening fully open.

Still another system for enchancing the flow of gas to the perimeter or to the collection point in the central panels is to place elongated floats under the cover as previously described and then to place small weights on both sides of the floats spaced parallel thereto.

A further system for enchancing the flow of gas to the perimeter or to the collection point in the central panels is to construct the cover with material having a different weight per square area. Thus by placing the lightest weight material closest to the periphery or the collection point on the central panel, the gas will have less difficulty in migrating to the collection point due to the decrease in pressure caused by the weight of the cover as the gas approaches the manifold collection point.

It has been found that the different means enchancing gas migration also enchances the flow of surface water in the opposite direction.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view of a reservoir covered by a gas collection cover constructed in accordance with the present invention.

FIG. 2 is a cross sectional view of the reservoir shown in FIG. 1 taken generally along the line 2--2.

FIG. 3 is a cross sectional view of a portion of the reservoir of FIG. 1 taken along line 3--3.

FIG. 4 is a plan view of a reservoir with a gas collection cover similar to the cover shown in FIG. 1 but with additional weights to enhance the migration of gas to the collection manifold.

FIG. 5 is a cross section of the reservoir of FIG. 4 taken along line 5--5 of FIG. 4.

FIG. 6 is a cross sectional view of a portion of the reservoir shown in FIG. 4 taken alone line 6--6.

FIG. 7 is a top plan view of a reservoir covered by a gas collection cover similar to the cover in FIG. 1 but with two additional forms of systems for enhancing the migration of gas to the gas collection manifold. The system on the left side to the cover includes a systems of floats and the system on the right side of the cover includes a system of floats and small weights. START OF COL. 3

FIG. 8 is a cross sectional view of the reservoir and cover shown in FIG. 7 taken along line 8--8.

FIG. 9 is a cross section of a float taken along line 9--9 of FIG. 7.

FIG. 10 is a cross sectional view of a float taken along line 10--10 of FIG. 7.

FIG. 11 is a cross sectional view of the form of the gas migration enhancement system taken along line 11--11 of FIG. 7 showing the use of alternating floats and small weights.

FIG. 12 is a top plan view of a reservoir showing still another gas collection cover.

FIG. 13 is a cross sectional view of the reservoir and cover in FIG. 12 taken along line 13--13.

FIG. 14 is a cross sectional view of a portion of the cover taken along line 14--14 of FIG. 12.

FIG. 15 is a top plan view of another form of the invention. The floats and weights are illustrated in the positions they are located when the reservoir is empty. The broken lines indicate the perimeter of the sumps and horizontal cover portions.

FIG. 16 is a cross sectional view of the reservoir of FIG. 15 taken along line 16--16. The position of the cover, weights and floats illustrate the position of these members when the reservoir is at the full level.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

With the modifications set forth in this application, all of the covers for all of the types of reservoirs described in my co-pending application, Ser. No. 06/425,556 may be used to collect gases which are

either introduced into the reservoir or generated in the reservoir. All water contains entrained air and some reservoirs which have an unusually high air content will benefit from the adoption of the present cover. In most instances, however, the gas is generated by anerobic means from waste animal or plant material. Methane gas is a common gas generated by the decomposition of such wastes.

It is also useful in certain processes to charge air or gas into a body of liquid and or solids. This cover may be used where it is necessary to collect these charged in gases and the gaseous products of the process.

The present cover with slight modifications may be used in many configurations of open reservoirs. Three well known general categories of reservoirs are those with vertical sidewalls, sloped sidewalls and reservoirs having both vertical and sloped sidewalls. These reservoirs may have varying geometric shapes in plan, but for purposes of brevity, only the sloped sided rectangular reservoir will be described. It is to be understood that the reservoirs referred to may have an area of a few hundred square feet to several hundred acres.

Referring to FIGS. 1-3, the tensioned reservoir cover for placement upon the fluid surface 2 of an open reservoir 3 consists of a flexible cover member 1 of substantially fluid impervious material of sufficient area to cover the sidewalls and bottom of the reservoir when empty.

Means are provided for connecting the perimeter of the cover member to the perimeter of the reservoir. Standard connections may be used and are commercially available. A gas collecting means is located at the periphery of the reservoir and may consist simply of a manifold pipe 4 formed with openings to permit gas to enter along its length. The manifold pipe preferably extends around the entire perimeter of the reservoir so that as soon as the gas exits the perimeter of the cover, it is carried away in the perimeter manifold pipe.

The weighting means may consist of any semi-flexible or segmented weights in line such as a plurality of sand filled tubes 5-13 positioned with respect to the cover member at pre-selected locations. The tubes are preferably made from the same material used to make the cover. Any type of material may be used for the weights but sand is preferred since it is inexpensive, flexible and does not tear the cover material. The weights may be positioned with respect to the cover member either by gravity and friction but preferably some mechanical connection such as bonding is made between the weights and the cover to insure that they do not roll or move about. The weights for a slope sided reservoir of rectangular configuration are positioned as shown in FIG. 1. Weight 5 is placed at the approximate center line of the reservoir and extends towards reservoir sides 14 and 15 and extends to points approximately at the intersection of lines bisecting the corners of the reservoir. Weights 6 and 7 lie along the line bisecting the angle 16 formed by the intersection of sides 17 and 14. Weights 8 and 9 lie along the line bisecting the angle 18 formed by the intersection of reservoir sides 14 and 19. Weights 10 and 11 lie along the line bisecting the angle 20 formed by the intersection of sides 19 and 15. Weights 12 and 13 lie along the intersection of angle 21 formed by the intersection of reservoir sides 15 and 17. Note that end 22 of weight 7, end 23 of weight 9; and end 24 of weight 5 terminate a distance from one another so that as the reservoir fills, and the ends of the weights move toward one another, they will not touch so as to create stresses in the cover. A spot weight 25 is preferably connected to the cover at the approximate center of the intersection of lines extending from each of the three lines of weights. Also, end 26 of weight 5, end 27 of weight 11 and end 28 of weight 13 terminate a distance from one another. Spot weight 29 is preferably connected to the cover at the approximate center of the intersection of lines extending from each of the three lines of weights.

Referring to FIG. 1, lines 30-33 represent the toe of slope sides 34-37 respectively.

The weights are shown as they would appear when the reservoir is empty. The phantom lines designated the border lines between the sumps 38-42 and the generally horizontal cover portions 43-46 when the reservoir is full.

Each of the cover sump portions formed in the cover by the weighting means for all operational fill levels of the reservoir is defined, narrow, elongated and interconnected with all of the other sumps. As shown in FIGS. 2 and 3, the sumps have generally vertical walls as illustrated by the numbers 47 and 48. The sumps are pre-programmed located over the entire range of working fluid level conditions. The sumps and the horizontal cover portions form in substantially the same location for each fill level.

The weighting means create in the cover member a plurality of biaxially tensioned horizontal cover portions 43-46 which sometimes are referred to as plates. The tension is biaxial in that the placement of the weights creates a horizontal force in two different horizontal directions over the entire range of working fluid levels and over substantially the entire area of the reservoir such that workmen can walk upon every horizontal portion of the cover without any flotation support or even special foot pads. The biaxial tension in the cover member for a vertical sided reservoir results from placing the weights on the cover so that at least two defined sumps cross or are coincident with substantially all section lines extending across non-adjacent sides of the reservoir.

END OF COL. 4

The biaxial tension in the cover member for a slope sided reservoir results from placing the weights on the cover so that at least a single defined sump crosses or is coincident with substantially all section lines extending across non-adjacent sides of the reservoir.

The sumps are interconnected so that surface water draining into any sump may flow into all of the sumps so that one or more strategically located sump pumps or drains can drain all of the sumps. Since the sumps maintain generally the same location, the drains or sumps need not be moved about to dewater the surface water from the reservoir.

The horizontal cover portions 43-46 have a selected geometric shape and are positioned at a selected location for all working fill levels of the reservoir. Workmen entering onto the reservoir cover can be assured that the location of the sumps will not change and that the horizontal cover portions will remain substantially planar in sustaining the weight of the workmen.

It has been discovered that as gas builds up beneath the cover, it tends to migrate along the underside of the cover to the perimeter of the reservoir. As shown in FIGS. 1-3, a manifold pipe 4 with openings along its length is placed entirely around the reservoir. A take-off pipe 49 is connected to the manifold pipe and a vacuum pump 50 may be inserted into the system to facilitate the recovery of the gas.

It should be noted that as the reservoir fills, the sump weights lift off the bottom of the reservoir. Thus at all working fill levels, the weight of the sump weights cause the vertical sidewalls of the sumps and the horizontal portions to be in biaxial tension such that workmen can freely traverse all horizontal portions of the cover. Since the sumps pose a potential hazard to workmen, it is customary to attach floats to either the top or underside of the cover adjacent and on both sides of the sumps. The floats serve to further define and visually locate the sumps and serve as an emergency hand hold should a workman accidentally fall into a sump.

Still referring to FIGS. 1-3, it has been found that the migration of the gas beneath the cover can be enhanced to flow more rapidly to the periphery and to the manifold pipe 4 without the addition of any more inlet pipes, manifolds or by the addition of heavier duty suction pumps. Gas enhancement may be effected by simply constructing the sump weight members which extend from proximal locations bordering the perimeter of the reservoir so that they have an increasing linear weight in direct proportion

to the distance from the proximal location at the perimeter of the reservoir. In other words, weights 6 and 7 increase in weight from the proximal point 51 to the distal point 22; weights 8 and 9 increase in weight from the proximal point 52 to the distal point 23; weights 10 and 11 increase in weight from the proximal point 53 to the distal point 27; and weights 12 and 13 increase in weight from the proximal point 54 to the distal point 28. Weight 5 has the same linear weight distribution throughout its length.

To illustrate the effect of the varying linear weights of sump weights 6-13 on the migration of gas toward the periphery of the reservoir, consider the three arbitrary points 55-57 on horizontal cover portion member 46, and arbitrary points 58 on sump weight 6 and arbitrary point 61 on weight 12. Points 58 and 61 form a straight line which is parallel to the side 17 of the reservoir. The weight at points 58 and 61 exert forces acting in opposite directions and exert a tension force at point 55. The weights at point 59 and 62 which are in a straight line and parallel to side 17 are greater in weight than the previous weights and therefore exert a greater tension force on point 56 than is exerted at point 55. Likewise, the weights at points 60 and 63 are even greater than the previous two weights and therefore exert an even greater force on point 57 which lies in a straight line with points 60 and 63 and parallel to side 17. Looking at the graduation of pressure from the view point of a bubble of gas which rises to the surface, the pressure of the cover on the surface is less in the direction of the perimeter of the cover so the migration of the bubble of gas is enhanced in the direction of the perimeter. Since the weights are preferably gradually increased in weight, the pressure on the gas is likewise an evenly increasing graduation and therefore the gas moves slowly under the decreasing pressure toward the perimeter and the gas collection manifold.

Since all of the sump weights except weight 5 are linearly heavier as the distance from the perimeter increases, all of the horizonal cover portions 43, 44 and 45 exert a graduated pressure in the identical manner as just discussed. Thus, gas moves from the center of the reservoir to the nearest perimeter point in a generally straight line. Removal of the gas as quickly as possible reduces the hazards connected with an accumulation of gas and there is less tendency for the cover to develop large bubbles of gas which lift the cover and render it subject to damaging wind forces.

Referring to FIGS. 4, 5 and 6, another means for enhancing the migration of gas is illustrated. The cover illustrated is similar to the cover shown in FIG. 1 and the description is not repeated. In this form of the invention, a plurality of surface weight means are shown which have a linear weight substantially less than the linear weight of the sump weighting means previously described. The surface weight means include a plurality of elongated surface weight members 64-75 which extend from proximal locations bordering the perimeter of the reservoir and carry the number designations 76-87 and terminate at distal locations 88-98. The surface weights depress portions of the horizontal cover portions along selected lines extending from the proximal locations to the distal locations. The surface weights follow generally straight lines which intersect the perimeter of the reservoir at generally right angles. The surface weights delineate a path means indicated by the numbers 99-106 for enhancing the migration of gas from beneath the horizontal portions of the cover to the gas collection means bordering the perimeter of the reservoir. For example, gas beneath path 99 will tend to stay between weights 64 and 65 rather than stray beneath triangular cover portion 107 or beneath path 100. Instead, the gas will tend to travel directly to the edge of the cover and into the collection gas manifold.

To enhance the migration of gas even more effectively, each of the surface weights 64-75 may be constructed having a progressively increasing linear weight in direct proportion of the distance from the proximal location at the perimeter of the reservoir to the distal location. Since the surface weights are preferably made from tubes made from the same material as the cover and filled with sand, it is a simple matter to make the tubes in the shape of an elongate narrow truncated cone instead of a simple cylinder. For example, if weights 64 and 65 are constructed so that they are heavier at distal locations 88 and 89 than they are at proximal locations 76 and 77, greater pressure will be exerted on the surface gas by the

cover adjacent locations 88 and 89 than in the path 44 at locations adjacent the proximal locations 76 and 77 and thus the gas will tend to migrate faster and more directly to the perimeter of the cover and into the manifold pipe 4.

It is to be understood that the surface weights constructed with the linear increasing weight feature can be used with the sump weights which also have the linear increasing weight feature previously described.

Another system of enhancing the migration of gas from beneath the cover to the peripheral manifold system is to use top side floats instead of surface weights. The floats may be aqy closed cell light weight plastic foam material of any geometric cross section but preferably rectangular. The floats may be covered with the same material as that used in constructing the cover. The floats would have the same length as the weight members shown in FIGS. 4-6 and be placed on top of the cover in the exact locations as the surface weights. The floats would indeed have some weight and would depress the cover slightly as is the case with the tubular sand filled weights. The floats, however, would facilitate safer access to the cover and would provide further safety provision for if the cover should develop a tear, the floats would stop the progression of the tear and would serve to buoy any workmen trapped on the cover. The path means for the migration of the gas would be identical to paths 99-106 shown in FIG. 4.

In order to provide even greater stability to the cover, weights may be connected to the floats. This system would be used in areas subject to high winds and/or covering reservoirs where unusually great amounts of gas are charged in or produced.

Referring to FIGS. 7-10, another form of gas migration enhancing system is illustrated. The reservoir is a rectangular sloped wall structure as previously described in referring to FIGS. 1 and 4. The cover actually illustrates two different gas migration enhancing systems which would not normally be used on the same cover but are here shown on one cover for purposes of brevity of drawings. The enhancement system shown on the left side of the drawing will be considered first. Before proceeding, however, the sump weights are identical to the sump weights previously described in FIGS. 1 and 4 except that the sump weights are constructed with the progressively increasing linear weight feature which has also been described. For this reason, the like parts of the reservoir and sump weights retain the same numbers and the description is not repeated.

A plurality of elongated cover lifting float members are located under each horizontal cover portion of the entire cover. For example, cover lifting float members 111-113 are attached to horizontal cover portion 46. Proximal ends 114-116 of the cover lifting floats extend to locations adjacent the periphery of the reservoir and distal ends 117-119 extend to inner edge 120 of the horizontal cover portion or plate 46. The cover lifting float members may be constructed from a closed cell plastic and covered with the same material that is used to construct the reservoir cover. Each of the cover lifting float members is placed beneath the cover and the top surface of the float is connected to the cover as with a suitable adhesive. As shown in FIGS. 9 and 10, this leaves the sides 121 and 122 of the floats unconnected to the cover. The floats are spaced from one another in parallel leaving straight paths 123 and 124 therebetween. The floats follow generally straight lines and intersect the perimeter of the reservoir at generally right angles.

The cover lifting float members raise the cover above the fluid surface 2 as shown in FIGS. 9 and 10 leaving the sides 121 and 122 above the surface. Since the cover is in tension due to the sump weights such as sump weights 12', 13' and sump weights 6' and 7' pulling in opposite directions, the portions 125 and 126 immediately adjacent the float are pulled away from sides 121 and 122 of the float and form a constantly open passageway for passage of gas from the underside of the horizontal cover portion to the gas collection means bordering the reservoir.

Preferably, the cover lifting float members are large enough and have sufficient buoying to support a workman as well as lift the cover above the surface against the downwardly acting force of the sump weights. A still further enhanced gas migration system can be effected by constructing the sump weighting means which extend from the proximal locations bordering the perimeter of the reservoir so that they will have a progressively decreasing linear weight in proportion to the distance from the proximal location at the perimeter of the reservoir. This linear decreasing weight of the sump weight members causes the passages 127 formed between side 121 of the float and cover portion 125 and passage 128 formed by float side 122 and cover portion 126 as illustrated in FIG. 10 to be larger than passages 129 formed by float side 121 and portion 125 and passage 130 formed by float side 122 and cover portion 126 as illustrated in FIG. 9. The reason for the larger passage at the location of the illustration in FIG. 10 than the passage at the location of the illustration in FIG. 9 may be understood by considering arbitrary points 131 and 132 on sump weights 6' and 12' which are on a straight line with the location of FIG. 10 as illustrated on FIG. 7; the line being parallel to the side of the reservoir. Points 131 and 132 represent points on the sump weights where the linear weight is relatively greater than points 133 and 134 on sump weights 7' and 13' which lie along a straight line coincident with the point at which FIG. 9--9 is taken on FIG. 7. The greater weights nearer the perimeter cause a greater force on the cover which stretches the cover tighter and makes the gap between the cover and the side of the float larger. The larger passage between the float and the cover nearer the perimeter makes it easier for the larger volumes of gas to flow. This form of enhancement is particularly important where there is a suction pump used in combination with the manifold gas collection pipe. The suction force tends to contract the passage 127 and 128 and it is important that the force of the sump weights exert a greater force in creating the passage. This increase in the size of the passages 127 and 128 adjacent float 113 is illustrated by dashed lines 135 and 136 as illustrated on FIG. 7; dashed lines 137 and 38 along float 112; and dashed lines 139 and 140 adjacent float 111 in FIG. 7.

Referring to the right side of the reservoir cover illustrated in FIG. 7, still another form of gas flow enhancement system is illustrated. In addition to the cover supporting float members 141-143, which are constructed identically to the float members 111-113, surface weight members 144 and 145 are placed approximately midwwy between the float members. The surface weights have a substantially smaller linear weight than the sump weights so that only a relatively small depression is made in the cover at the location of the surface weights. The surface weight members extend along the horizontal cover portions along selected lines extending from proximal locations bordering the perimeter of the reservoir and terminate at distal locations distant from the perimeter of the reservoir. The surface weights are located between and generally parallel to the pairs of cover lifting float members and intersect the perimeter of the reservoir at generally right angles. The surface weight members cooperate with the sump weighting means in urging the gas to migrate toward the open passage ways 146-151 between the sides of the floats and the cover member. The gas migrates along pathways at right angles to the longitudinal axis of the floats and surface weights. Thus gas moves from surface weight 145 along short path 152 to passageway 147 as shown in FIG. 11. In like manner, gas moves from weight 145 along short path 153 to passage 148; along path 154 from surface weight 144 to opening 149, and along short path 155 from surface weight 144 to passage 150.

Referring to FIGS. 12, 13 and 14, a reservoir having a central panel 156 is shown. A central panel cover separated from the perimeter of the reservoir by peripheral sumps 157-160 is preferable in some reservoirs such as those having vertical sidewalls or where the surface area of the reservoir is very large and it is desirable to divide the reservoir into more horizontal cover portions. Thus, the reservoir illustrated in FIG. 12 in addition to having a central horizontal cover portion 156, also includes perimeter horizontal cover portions 161-164. All of the horizontal cover portions are maintained in biaxial tension, that is, the cover is stretched in two horizontal directions which are generally at right angles but at least have sufficiently different horizontal directions to support a workman traversing the

cover so that he does not need any special floatation equipment or large foot pad load spreading devices. The bilateral biasing is accomplished generally as previously described by sump weight members 165-172. These sump weights may be made by forming a tube of the material used to make the cover and filling it with sand. The weights are located on the cover and the cover is dimensioned so that as the water level rises, the sump weights will lift off the bottom of the reservoir and maintain the sump walls and the horizontal cover portions of the cover in biaxial tension for all working fill levels of the reservoir. The geometric shape of the reservoir need not be rectangular, in fact several different geometric shapes are shown in my co-pending application, Ser. No. 425,556, and all such shapes may be utilized in this application, such shapes include but are not limited to rectangular, polygonal, hexagonal, rectangular with a triangle at one end, rectangular with a semi-circular end, eliptical, and circular. Sump weights 166, 168, 170, and 172 form corner sumps 173-176 which intersect the corners of the reservoir and the peripheral sumps. Thus, all of the rainwater sumps are interconnected so that rain falling on any part of the cover finds its way to drain sump and can be drawn off, drained off, or pumped off from a single location in any one of the drain sumps if necessary. The drain sumps are preprogrammed located in that the sump is always in the same location for any given fill level of the reservoir.

The reservoir cover is connected to the perimeter of the reservoir and a gas collecting means such as a manifold pipe 4 as previously described is positioned so as to collect the gas which migrates from the perimeter horizontal cover portions.

A central gas manifold means is operatively connected to the gas collection means and the central cover panel 156. Referring to FIG. 12, the central gas manifold may consist of a central elongated float 177 which is attached on its top side to the underside of the cover. A central gas manifold pipe 178 is attached to the top side of the central elongated float 177 and runs along the top side of the float to a take-off pipe 179 which connects to the peripheral pipe 4. A suction pump 50 may be used to enhance the flow of gas from the cover.

Since the central portion of the cover is in tension, the cover will be pulled away from the sides 198 and 199 of the float. This creates spaces 200 and 201 permitting the collection of gas. Side cuts can be made in the float as shown by diagonal cuts 202 and 203 to permit the flow of gas from the spaces 200 and 201 to pipe 178. Pipe 178 may be formed with a plurality of openings along its length to permit the inflow of gas.

As shown in FIG. 12, spot weights 181-184 may be placed at the corners of the peripheral sumps 157-160. These spot weights should be spaced from the sump weight ends 185-192.

The form of the reservoir cover in FIG. 12 may be formed with a gas enhancement system in which the central area 156 of the cover is formed with an inner portion 193 surrounded by an outer portion 194. The inner portion 193 is formed from a cover material having a weight per square foot less than the weight per square foot of the cover material forming the outer portion. The differential in cover weight enhances the migration of gas formed beneath the cover inwardly of the central sump to the inner portion of the central cover area.

If the cover is very large or if an even steadier flow is required, one or more mid-cover portions 195 may be formed between the inner and outer cover portions which has a weight per square specification foot mid-way between the weight per square foot specification of the inner and outer cover portions. The differential in weight may be effected by simply adding plies of material, or by forming the material with different thicknesses or by adding graduated weights such as polyurethane resin or foam.

Preferably the horizontal cover portions formed in the cover between the central sump and the perimeter of the reservoir are formed with an inner peripheral portion 196 bordering the central sump and an outer

peripneral portion 197 bordering the perimeter of the reservoir. The inner peripheral portion of the cover bordering the central sump is formed from a cover material having a weight per square foot greater than the weight per square foot of the cover material forming the outer peripheral portion bordering the perimeter of the reservoir. The differential in cover weight enhances the migration of gas formed beneath the cover outwardly of the central sump to the perimeter of the reservoir by exerting less pressure on the cover as the gas approaches the perimeter of the reservoir and the manifold gas pipe 4.

The cover material may be made from various standard plastic or rubber materials such as Hypalon.

The present cover is particularly suitable for gas generation where heat is required to enhance the process. Since the cover rests directly upon the surface of the fluid, solar energy is transmitted directly to the surface. Only a small fraction of the cover is lifted above the surface by gas or floats.

Where the cover is used to collect methane gas from organic materials, it is desirable to layer a polyethylene membrane next to or beneath the Hypalon outer cover. A geo-textile insert may be layered between the Hypalon outer cover and the polyethylene. In this form, the Hyaplon outer cover is more resistant to weathering while the polyethylene membrane is more resistant to the methane gas, or the contained fluids. The important aspect of this feature is the fact that the different plies of different kinds of material need not be bonded to one another. Indeed, the different layers of material may be simply laid on top of one another without any connection therebetween. This layering feature is possible because the sump weights maintain all portions of the cover in tension and thus all layers of the cover are kept in close contact with the reservoir surface.

The present cover is completely sealed from the atmosphere so that where methane gas is being generated beneath the cover, oxygen from the atmosphere cannot mix with the methane to create a potentially explosive mixture of gases.

When the cover is in operation and gases are generated beneath the cover, blisters of gas will form and move toward the periphery of the reservoir or to the manifold in those covers which have a central portion surrounded by a peripheral sump. If a heavy rain should fall on the cover while blisters of gas are moving toward the gas manifolds, the water will tend to flow in the opposite direction of the gas; viz, toward the surface water sumps. Since the entire cover is in biaxial tenson, water will flow toward the sumps around the gas blisters and very little interference will be caused by the blisters in de-watering the cover. Since the cover will be completely de-watered within several minutes after the rain ceases, there is practically no interference by the rainfall in the migration of the gas toward the gas manifold pipes.

The fact that the entire cover is in biaxial tension, prevents the cover from rising above the surface more than a fraction of an inch or so. Further, the gas does not remain stationary beneath any one segment of the cover but moves steadily to the periphery or to a central manifold. This phenomenon, prevents the cover from being lifted above the surface and driven by strong winds. This prevents damage to the cover by tearing and further prevents the wind from moving the cover so as to interfere with the location of the surface water sumps or preventing the progression of gas to the gas manifolds.

In some processes where it is desirable or essential to trap the charged in or generated gas beneath the cover, the central cover portion system illustrated in FIG. 12 is particularly suitable. The peripheral weighted sump traps the gas in the central area and if the gas manifold system is closed, the gases will remain beneath the central cover portion. Curtain members may be hung beneath the peripheral weighted sumps to insure that gas does not migrate beneath the peripheral sump areas to the periphery of the reservoir.

Another method of obtaining variable weighting of the cover in addition to using cover material of different weights or thicknesses is to add a material to the cover such as sand mixed with a suitable binder which is adhered to the cover surface. The sand may be added in multiple layers in selected areas to provide weighting heavier in some areas than in others. Preferably the weighting is evenly graduated from light to heavy so that the gas will move steadily rather than moving swifty from one weight boundary to another.

In this application, I have indicated that different weight materials may be used in the cover as applied to covers with central portions as illustrated in FIG. 12. In fact, the variable cover weight system described may also be used with the cover systems shown in FIG. 1, 4 and 7. For example, in FIG. 1, panel 46 may be formed with cover material of varying weight so that the cover portions adjacent sump weight 5 is heavier than the cover adjacent the periphery 17 of the reservoir. Thus, gas adjacent sump weight member 5 will travel faster to the periphery. This same procedure may also be applied to cover portions in FIGS. 4 and 7. In these covers, graduated weight covers may be used in individual panels such as panel 104 to cause gas to move to the center of the panel. This may be accomplished by providing heavier cover material adjacent the surface weight members 71 and 72.

Referring to FIGS. 7, 8 and 9. A variable cover weight may be used to enhance the migration of gas to the gas spaces 127, 128, 129 and 130. This may be accomplished by providing a heavier weight cover material between the floats 111, 112 and 113.

Referring to FIG. 12, it should be understood that the gas enhancing systems as described in connection with FIGS. 1, 4 and 7 may be used to enhance the movement of gas to the central elongated float 177. This includes variable sump weights; surface weights; floats beneath the cover; and combinations of surface weights and floats beneath the cover.

In the specification and claims, the degree of tension in the cover has been referred to as that amount of tension necessary to permit a workman to traverse all portions of the cover. Applicant in no way warrants that this cover will always support a workman and does not encourage workmen to walk on the cover without prescribed safety equipment.

Referring to FIGS. 15 and 16, an ambient wind gas flow enhancement form is illustrated. It has been observed that when a gas bubble forms beneath the cover, a moderate wind can move the bubole along the underside of the cover. This form of the invention makes it possible to capture such bubbles at the periphery of the reservoir in manifold pipe 4 or at the edges of all the rainwater sumps.

Elongated sump edge floats 204-224 are placed beneath the cover adjacent the sumps 38-42. The entire cover is in biaxial tension as previously described in relation to FIGS. 1, 4 and 7. The cover is affixed to the top of the float only as described in relation to, for example, float 113 in FIG. 10. Thus, a gas space is formed between the underside of the cover adjacent the side of each of the floats 204-224. This gas space is illustrated in FIG. 16 and designated by the numbers 225 and 226. The borders of these gas spaces are illustrated in FIGS. 15 and 16 by the dotted lines 227-246. All of the gas spaces are joined to one another. Where the floats are separated by paths to permit water to drain from the horizontal cover portions to the sumps, a short gas hose designated by the number 247 joins the gas space adjacent floats 204-224. At the corners of the reservoir, the gas spaces are connected to manifold pipe 4 by short gas hoses 248.

The operation of the cover illustrated in FIGS. 15 and 16 is as follows: When a gas bubble forms beneath the cover such as gas bubble 249, the bubble will move in the direction of the surface wind as indicated by arrow 250. In this case, if the wind continued to blow in the direction shown for a sufficiently long time, bubble 249 would move to gas space 225 adjacent float 220. The gas would then

travel through the spaces adjacent the floats through gas pipes 247 and 248 until it reached manifold 4 at the perimeter of the reservoir.

Rainwater falling on the horizontal cover portions would flow into the sumps in the rain paths beneath pipes 247 and between the ends of the floats.

In like manner, floats can be placed beneath the cover adjacent the sumps in a reservoir having a central panel as shown in FIG. 12. Gas pipes similar to pipes 247 would connect all gas spaces formed between the ends of floats which were spaced to provide a rainwater path to the drain sumps. The floats adjacent the corners would have gas pipes similar to pipes 248 to connect the gas spaces to the manifold pipe 4. Providing this gas collection system in a central panel reservoir as illustrated in FIG. 12 is especially adapted for processes where air or a process gas is introduced into the reservoir and bubbled up from the bottom of the reservoir. By closing the gas manifold 4, the process gas can be retained in the reservoir until the process is complete. The generated gases and process gas can then be drawn off through the gas spaces adjacent the floats and through a central manifold 179 as shown in FIG. 12.

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# EXHIBIT 4

C1

November 8, 1984

2157-3.4/2.1

Schlegel Lining Technology Inc.
200 South Trade Center Parkway
P. O. Box 7730
The Woodlands, Texas 77380

ATTENTION: MR. RAYMOND JASIENSKI

RE: PROPOSALS FOR POND MEMBRANE

Gentlemen:

ADI International Inc. is presently designing modifications to an industrial waste treatment system, which includes an earthen anaerobic digester (ADI-BVF) for an A. E. Staley Corporation plant, in Lafayette, Indiana.

Tendering for this work is scheduled for March, 1985 and construction is scheduled to start in April.

We wish to pre-select a contractor for the membrane portion of the work required for the ADI-BVF. Your firm is invited to submit a proposal, according to the enclosed details and requirements, and submit it to:

ADI Limited
P. O. Box 44
1115 Regent Street
Fredericton, NB
Canada
E3B 4Y2

by November 27, 1984.

....2

This proposal will be used by ADI to evaluate and select a membrane contractor for the supply and installation. This evaluation will take place in December to formulate a recommendation for acceptance to A. E. Staley by December 14, 1984.

The owner reserves the right to reject all or any of the proposals submitted.

Should you require any additional information, contact ADI, at (506) 452-9000.

Yours truly,

CLAUDE DeGARIE, P. ENG.

CD/JFB

Enclosure

cc: A. E. Staley

CONTENTS

## 2 TREATMENT SYSTEM

The wastewater leaves the factory by a gravity sewer to a central pumping station. The pumping station will be discharging a fraction or all of the wastewater directly into the ADI-BVF*. (Some chemicals may be added in plant for nutrient or pH balance of the fermentation process.)

Activated sludge generated by the aeration process will also be pumped into the ADI-BVF. These amounts are relatively minor when compared with the quantity of incoming flow from the factory.

* ADI Trademark

3. SCOPE

This proposal is calling for the supply and installation of an insulated membrane cover for the ADI-BVF. In addition, the supply and installation of a flexible membrane liner for the pond floor may also be required.

Two options are described for the insulated cover system and both must be priced out. The first system (1A) consists of an almost continuous 1/2 inch Ethafoam sheet overlaid with a cover membrane. The membrane cover shall be complete with:

1) Weighted and well defined fabric fold to allow a water level fluctuation of 6 feet.
2) A perimeter biogas collector for the collection of biogas migrating to the surface (pipe supplied and installed by others)
3) Weighted lines at regular intervals to force the biogas to the perimeter of the pond surface
4) Perimeter tie and membrane skirt to 3 feet below the low water level
5) Two access hatches for inspection complete with floats, locking covers and membrane skirts
6) Two access hatches sized to lower low speed mixers on rail into the pond and complete with locking covers and membrane skirts (size of opening 100 inches by 24 inches)
7) Twelve sampling ports consisting of PVC risers and threaded caps.
8) Ethafoam 220, 1/2 inch thick, supplied by Dow Chemical in roll form shall be fused by overlapping each fabric strip into a continuous sheet except in the fold location. The foam insulation will be fastened to the underside of the cover membrane by taping and fusing fabric wicks to the cover material at 15 foot intervals each way

The alternative cover arrangement (1B) is very similar to the first description and contains all the above mentioned items except for the following:

1) Supply and install an 18 inch biogas collection pipe (300 feet long) consisting of floatation and perforated collector pipe placed longitudinally in the center of the pond. A flexible connection shall also be included to connect to the rigid collection system installed on the pond berm during pond construction.

2) Perimeter of the pond cover shall be completd with a 4 foot weighted skirt and ropes tied to the concrete wall with a series of eye bolts and gromets at 18 inch intervals.

Field installation of either alternative could begin as early as June and August, 1985 and should be completed in 8 weeks including all the necessary inspection testing, pond filling (seven days to operating level) and perimeter fastened.

The second item which may be required is a pond liner and should be priced completely separately from the cover systems.

The pond shall be constructed of on site sand and gravel material and may include a clay lining before the membrane construction can begin. Four distribution lines 12 inch diameter will be placed on the pond floor. Each pipe contains eight distribution ports flanged to the liner membrane. Two flat concrete platforms 10 feet by 15 feet are provided on the pond floor to install (by others) the slow speed mixers.

The membrane installation shall include sealing to each item mentioned above and membrane fastening to the base of the concrete wall.

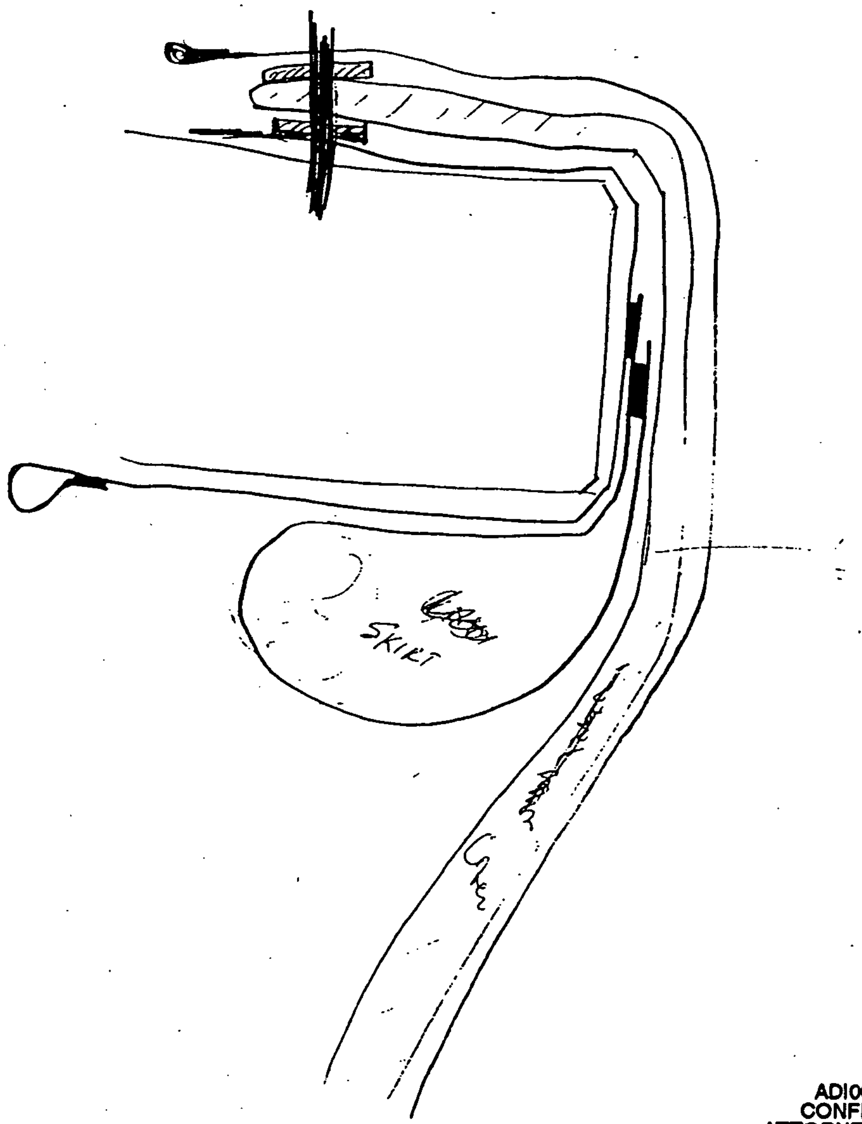
The field installation could begin August 1st, 1985 with all membrane work completed as described above for October 1st, 1985.

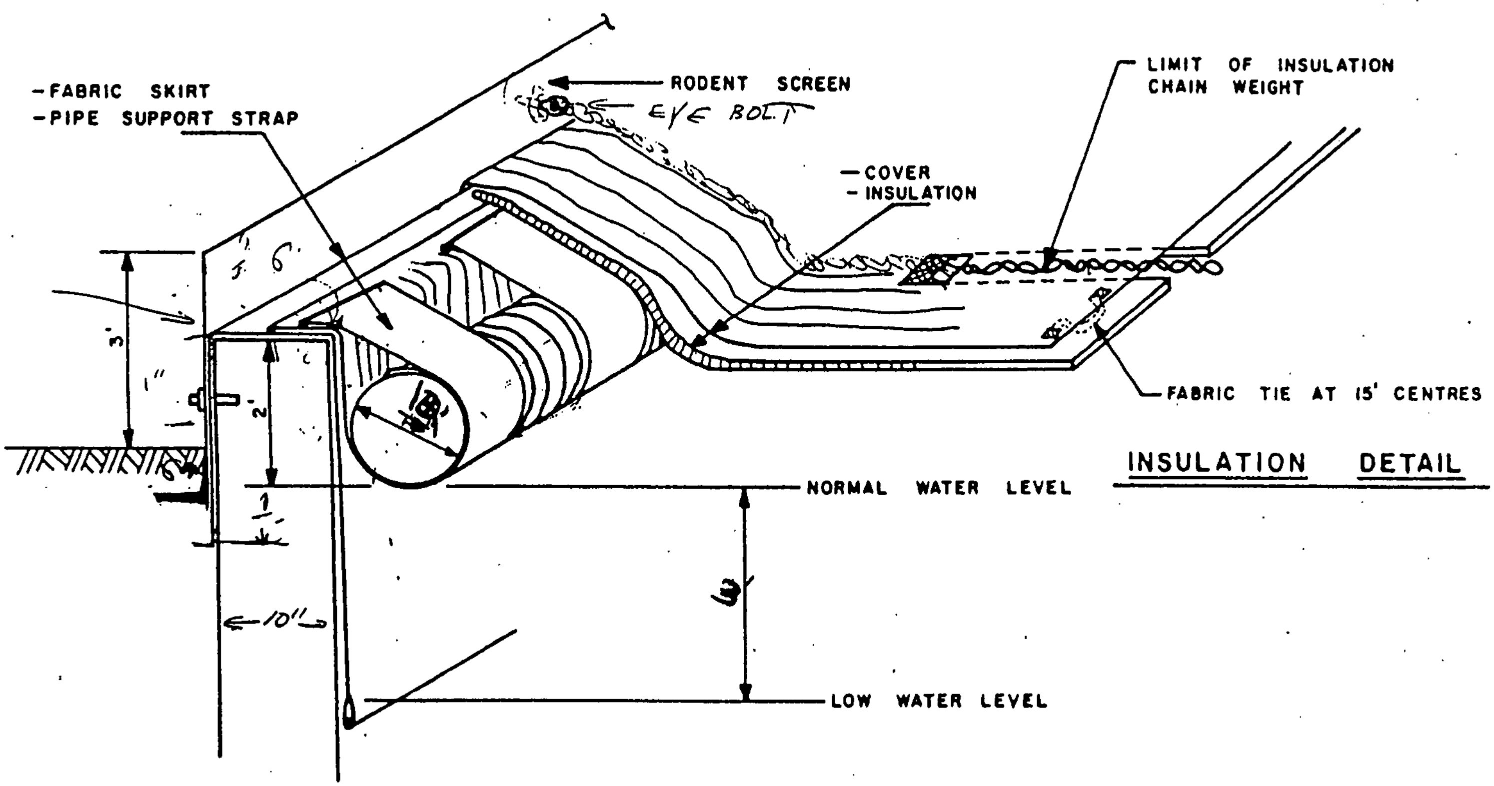
The next section lists a few drawing sketches to supplement this description.

## 4 DRAWINGS

Drawing 21 - General location of the ADI-BVF (located in back pocket).

Drawing 1.1 - Cover details
Drawing 1.2 - Typical section with membranes in place
Drawing 1.3 - Portion of the cover system
Drawing 1.4 - Floor piping
Drawing 1.5 - Access hatches with mixing equipment
Drawing 1.6 - Biogas collector pipe and cover (Alternative 1B)


SKIRT

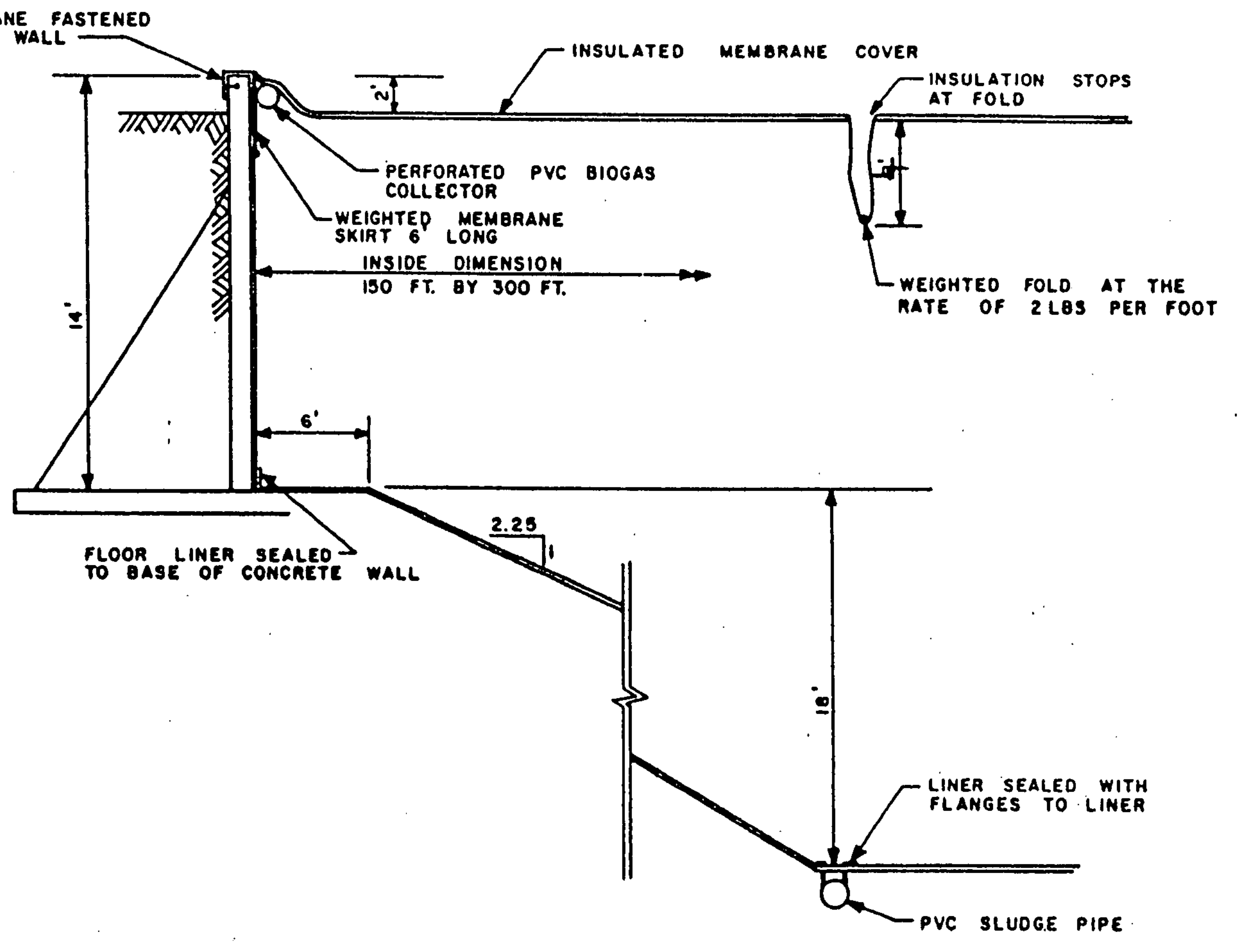



## BIOGAS COLLECTOR

## INSULATION DETAIL

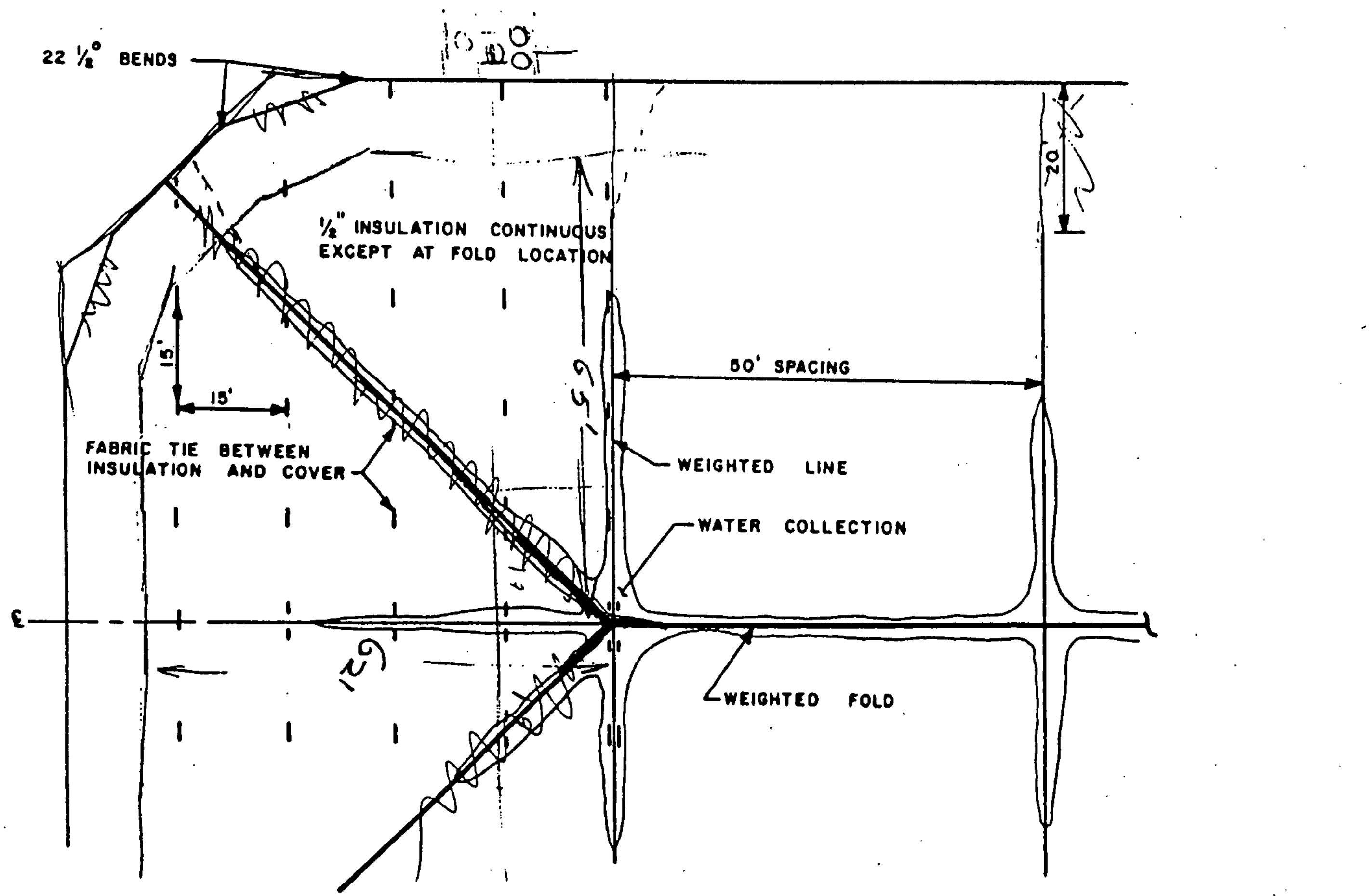
| | | |
|---|---|---|
| Project Title: ADI-BVF | ADI Engineering, Architecture, Planning, Management Consulting, Surveying (506) 452-9000 1115 Regent Street Fredericton, NB | Project: 2157-3.4 |
| Dwg. Title: DETAILS | | Dwg.: 1-1 |
| | | Drn. By: D. R. J. — Scale: — Date: NOV./84 |

ADI107 84 04

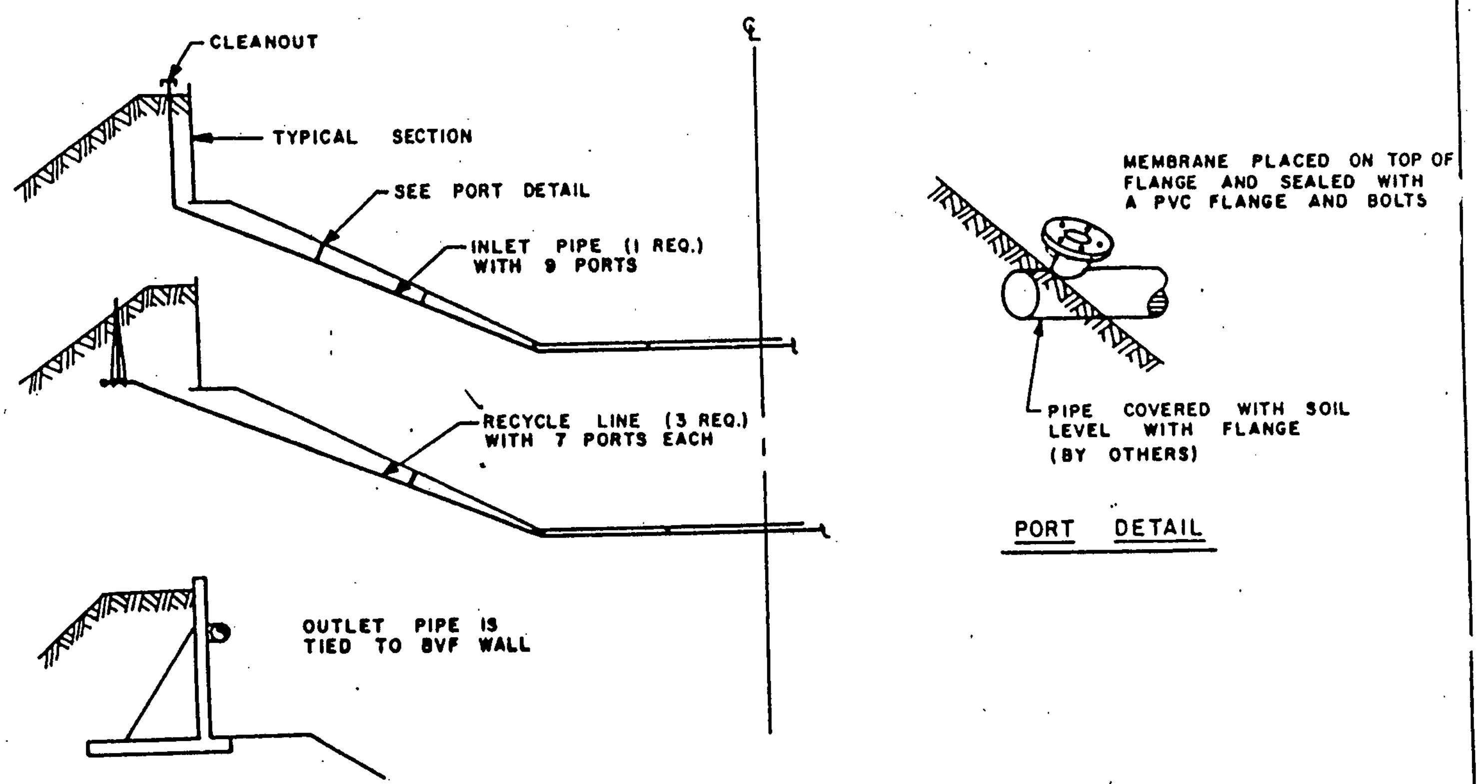



| Project Title: ADI-BVF | ADI Limited<br>Engineering, Architecture, Planning<br>Management Consulting, Surveying<br>(506) 452-9000<br>1115 Regent Street<br>Fredericton, NB | Project: 2157-3.4 |
|---|---|---|
| Dwg. Title: TYPICAL SECTION | | Dwg.: 1.2 |
| | | Drn. By: D. R. J. / Scale: / Date: NOV./84 |

ADI107 84 04

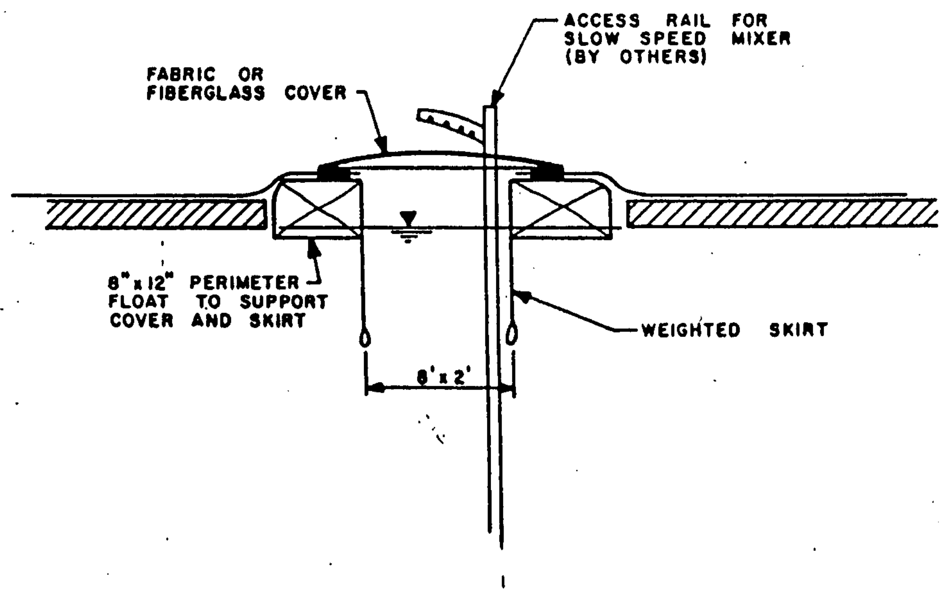



| | | |
|---|---|---|
| Project Title: ADI-BVF | ADI — Engineering Architecture Planning, Management Consulting Surveying, (506) 452-9000, 1115 Regent Street, Fredericton NB | Project: 2157-3.4 |
| Dwg. Title: PORTION OF MEMBRANE COVER | | Dwg.: 1.3 |
| | | Drn. By: D.R.J. / Scale: / Date: NOV./84 |



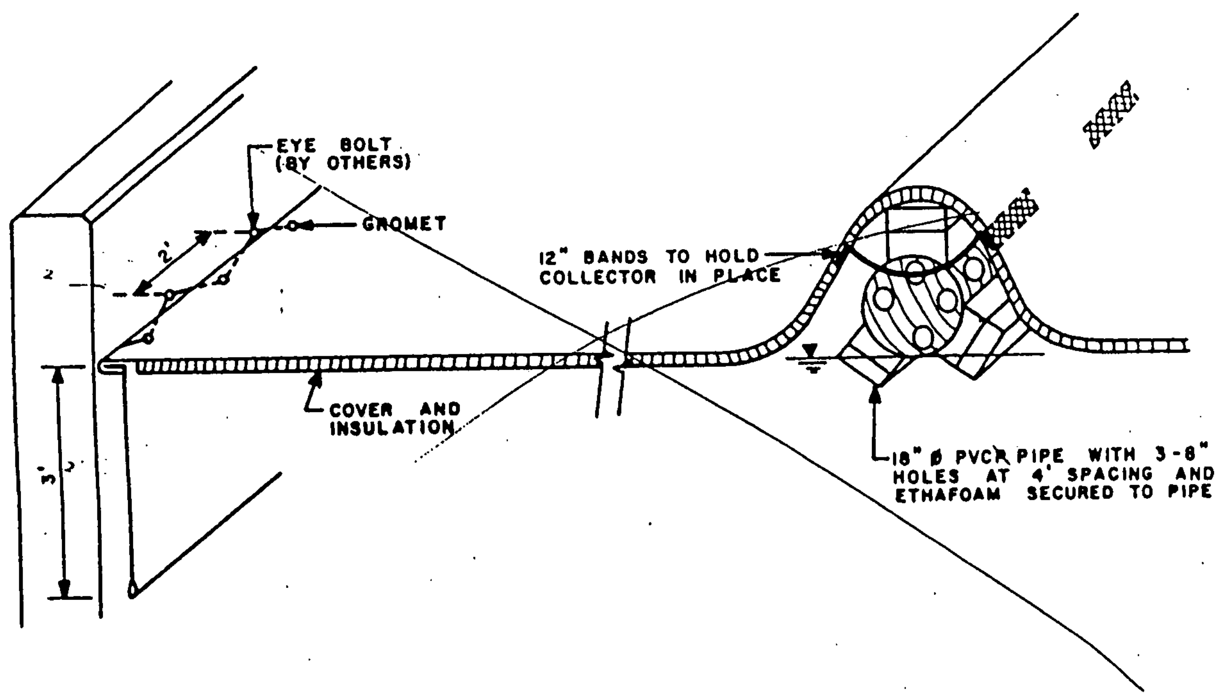

| | | | | |
|---|---|---|---|---|
| Project Title: ADI-BVF | ADI Engineering, Architecture, Planning, Management Consulting, Surveying (506) 452-9000 1115 Regent Street Fredericton NB | Project: 2157-3.4 | | |
| | | Dwg.: 1.4 | | |
| Dwg. Title: FLOOR PIPING | | Drn. By: D.R.J. | Scale: | Date: NOV./84 |

ADI0107 84 04




| | | | | |
|---|---|---|---|---|
| Project Title: ADI-BVF | ADI Engineering Architecture Planning, Management Consulting Surveying (506) 452-9000 1115 Regent Street Fredericton, NB | Project: 2157-3.4 | | |
| | | Dwg.: 1-5 | | |
| Dwg. Title: ACCESS HATCH | | Drn. By: D.R.J. | Scale: | Date: NOV./84 |

ADI107 84 04




| | | |
|---|---|---|
| Project Title: ADI-BVF | ADI Engineering, Architecture, Planning, Management Consulting, Surveying (506) 452-9000, 1115 Regent Street, Fredericton NB | Project: 2157-3.4 |
| Dwg. Title: COVER ALTERNATIVE 1B | | Dwg.: 1.6 |
| | | Drn. By: D.R.J. · Scale: · Date: NOV./84 |

ADI107 84 04

## 5 DESIGN CHANGES

The owner reserves the right to make the final decision on the size of the ADI-BVF, Alternative 1A or 1B and type of pond floor treatment.

A request may be made to adjust the prices quoted in this proposal to account for any design changes.

## 6 SHOP DRAWINGS

The successful contractor will be required to submit six sets of shop drawings to ADI showing the complete detail of membranes, factory seams, and field work as well as method of handling and seaming recommended by the material supplier. Drawings to be submitted shall include the perimeter fastenings, access hatches and biogas collector system, insulation and weighted systems.

7 PRICES QUOTED

Quotations shall be made according to the details described herein. Prices shall include for all materials, labour, plant and equipment necessary for a complete and satisfactory installation. Prices shall be quoted in U.S. funds, FOB factory with freight allowed to Lafayette, Indiana, and include all applicable duties, levies and taxes.

PRICE LIST

| | PRICE |
|---|---|
| ITEM 1A | |
| Supply and install complete an insulated cover system for perimeter biogas collection as described | $ __________ |
| ITEM 1B | |
| Supply and install complete an insulated cover system and central floating collector | $ __________ |
| ITEM 2 | |
| Supply and install complete a floor and slope liner complete with all appurtenances | $ __________ |

This tender is submitted by ____________________

Signature ________________ Date ____________

## 8 DESCRIPTION OF COMPANY

A brief history of the tenderer's organization and experience in membrane related projects should be included.

9 EXPERIENCE

Detailed list of experience in managing membrane construction and field installations.

| Project | Year | Materials Used | Person to Contact |
| --- | --- | --- | --- |

10 LIST MATERIALS PROPOSED

| Item | Materials | Detail | Equipment Used for Handling and Seaming |
| --- | --- | --- | --- |
| 1A) | | | |
| 1B) | | | |
| 2) | | | |

11 SUBCONTRACTORS

List all manufacturers, suppliers and subcontractors used at various stages of completion of membrane work.

| Material | Manufacturer/ Supplier/Sub | Scope of each Involvement | Supervisory Staff |
| --- | --- | --- | --- |

12 INSURANCES

In conjunction with Section 11 state the schedule and type of testing program proposed with each stage of construction of each material and the scope of warranties provided on material, labour or the complete system.

| Material/Subcontractor | Testing | Frequency | Warranty |
| --- | --- | --- | --- |

The successful bidder will receive effluent sample from the client for testing by the material supliers to ensure the materials and all fittings proposed are compatible with the wastewater being treated.

## 13 SCHEDULES

List the proposed schedule for every stage (shop drawings, material fabrication, shop assembly, field assembly) of the membrane systems. This schedule should be based on all the constraints outlined in previous sections.

## 14 RECORDS

A complete record of all design changes, repairs, test locations and results including shop and field conditions seaming equipment and supervisory staff shall be completed in two copies and reviewed for completeness by ADI prior to final approval of the membrane work.

## 15 SYSTEM TESTING

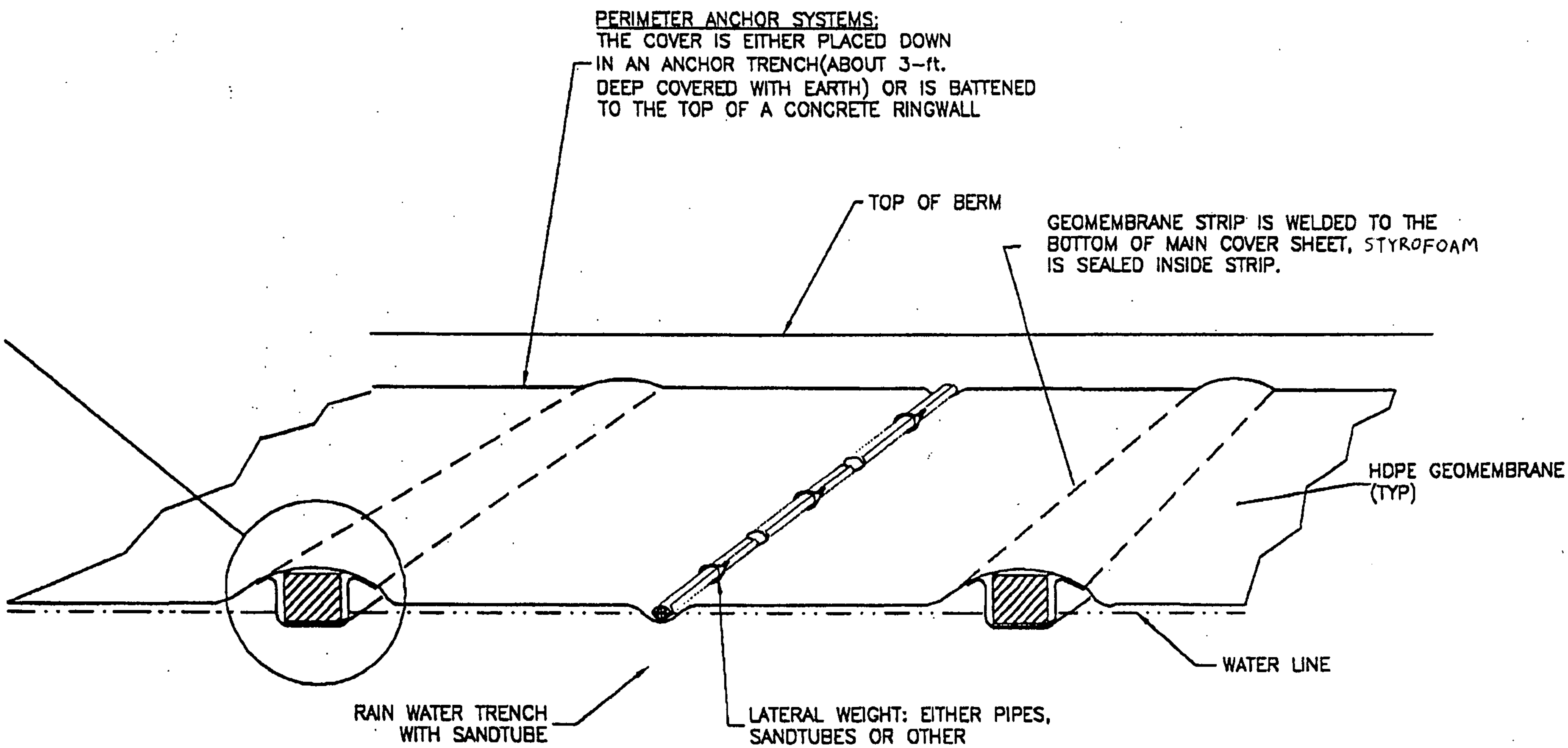
Once the cover is floating in its final position. The floor liner (if used) will be tested for leakage by ADI and accepted if leakages do not exceed 20% of the allowable exfiltration permitted by the Indiana state regulations.

The cover system will be tested by ADI and accepted if the infiltration rate does not exceed 0.5 cubic feet/min of infiltrated air under 1 inch water column suction pressure.

## 16 MAINTENANCE

The contractor will be responsible for supplying and updating a list of service personnel and telephone numbers that can be available in 48 hours should repairs to the system be required. Also the owner shall be provided with a repair kit complete with repair instructions to perform temporary and permanent repair operations.

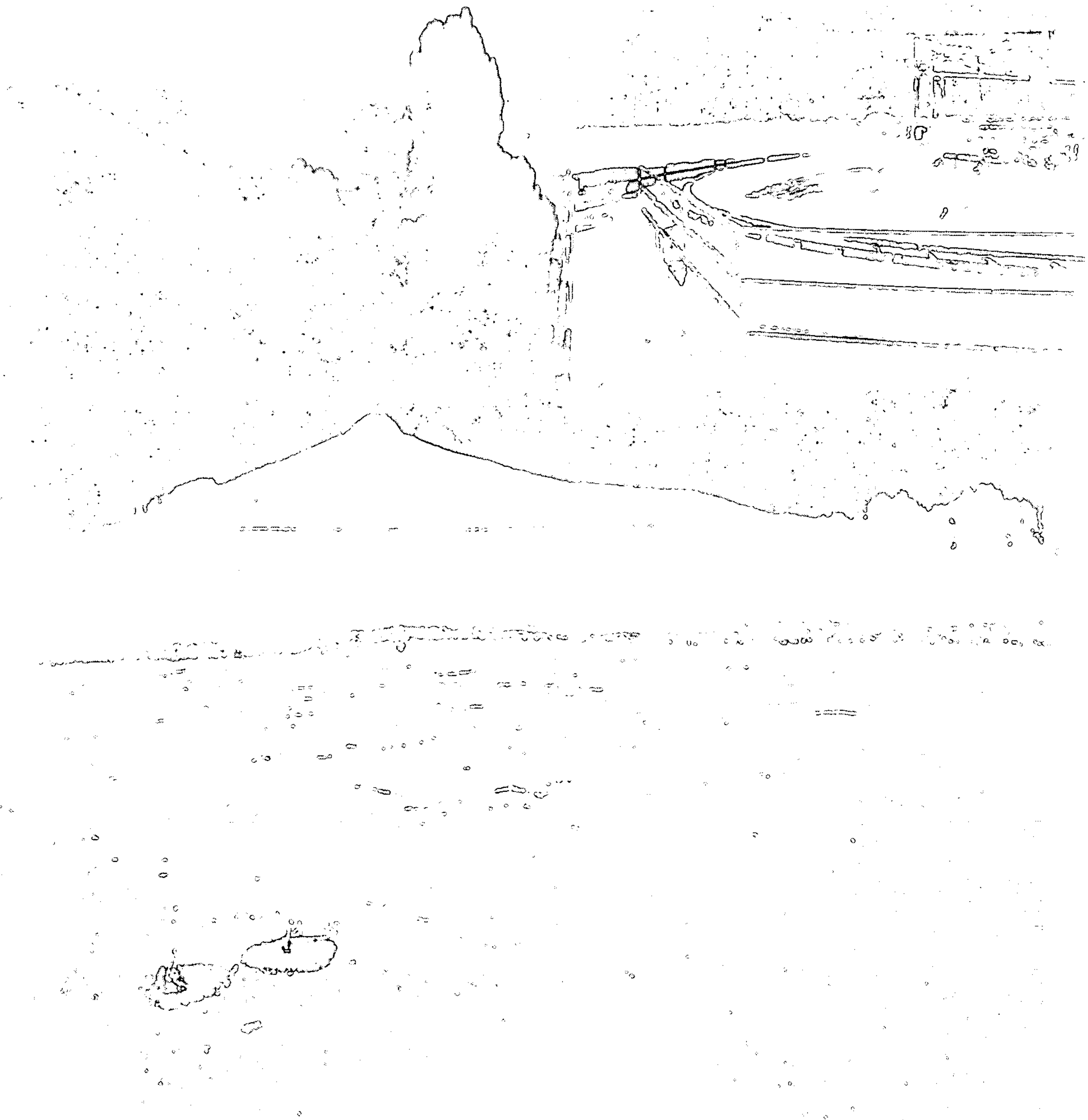
# EXHIBIT 5


PERIMETER ANCHOR SYSTEMS:
THE COVER IS EITHER PLACED DOWN
IN AN ANCHOR TRENCH(ABOUT 3-ft.
DEEP COVERED WITH EARTH) OR IS BATTENED
TO THE TOP OF A CONCRETE RINGWALL
TOP OF BERM
GEOMEMBRANE STRIP IS WELDED TO THE
BOTTOM OF MAIN COVER SHEET, STYROFOAM
IS SEALED INSIDE STRIP.
HDPE GEOMEMBRANE
(TYP)
WATER LINE
RAIN WATER TRENCH
WITH SANDTUBE
LATERAL WEIGHT: EITHER PIPES,
SANDTUBES OR OTHER

# EXHIBIT 6

C2

# LemTec
## Modular Cover Systems



LEMNA

SOLUTION PROVIDERS FOR WASTEWATER TREATMENT

# The Solution Is Simple . . .

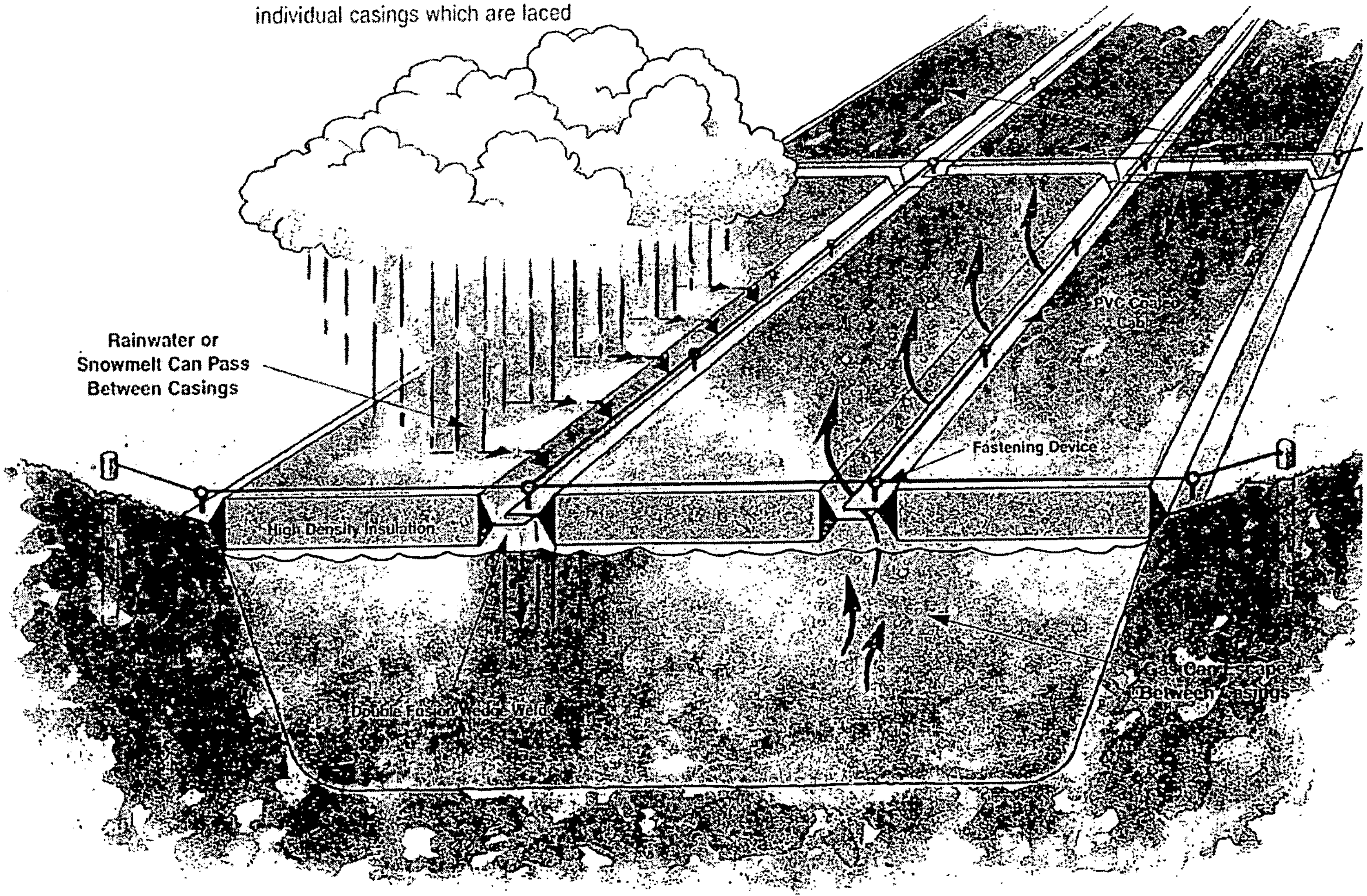
## LemTec™ Modular Cover Systems

At Lemna, we believe there is a solution to every problem. If your lagoons, ponds, basins or tanks have **problems with odors, algae growth, heat loss or gas production and collection,** the LemTec™ Modular Cover System is the answer. Our team of innovative design engineers have designed hundreds of wastewater treatment facilities since 1983, and can provide you with quality solutions to your problems.

The patented LemTec Modular Cover System consists of individual casings which are laced together during installation to form a complete cover over the liquid in the basin. Each individual casing is comprised of closed-cell insulation sealed between two sheets of durable geomembrane. The result is a unique floating cover system which provides an affordable solution for insulation, odor containment and/or algae control on ponds and tanks.

Each LemTec cover, custom engineered and configured to meet specific basin requirements, offers insulation R-factors ranging from 8 to 25 and a geomembrane capable of withstanding even the most severe environmental conditions. Our unique design allows rainwater to pass between the individual casings and gases to escape. Additionally, maintenance intensive water collection systems become a thing of the past.

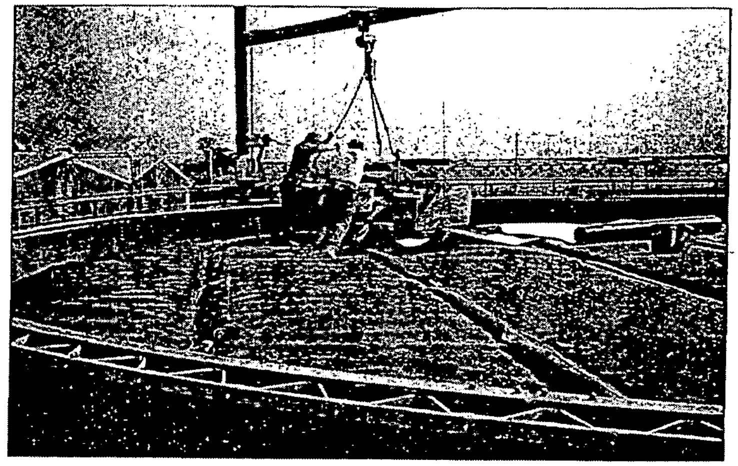
Using standard materials in innovative ways, we have created an effective solution that offers odor containment, insulation and algae control while minimizing both capital and O&M costs.



# LemTec™ Cover Used On Tanks

The LemTec Modular Cover for tanks offers a cost-effective alternative to aluminum and fiberglass domes. Typical applications include equalization tanks, aeration tanks, contact stabilization tanks or aerobic and anaerobic digesters.

- The cover is a superior product for **odor containment** because it covers 100% of the surface area.
- With insulation factors up to R-25, the LemTec cover provides **heat retention** in even the coldest climates.
- The LemTec cover can be designed to **adapt to varying water levels.**
- Because each cover is custom built, it can be fabricated **to conform to any tank shape.**
- **Openings** can be created to accommodate floating mechanical equipment, walkways and other stationary surface equipment.

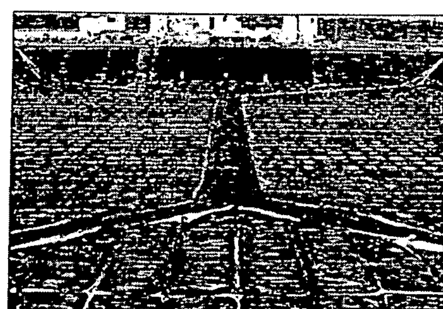


*LemTec Tank Cover with Cut-outs for Mechanical Equipment*

- **Hatches,** custom built to meet customer specification, allow for easy access to submerged equipment or for sampling.
- Where gas collection is not required, the LemTec Modular Cover **eliminates the need for a water collection system,** pumps...etc.
- Because the LemTec Cover is not an enclosed environment, **expensive venting and explosion proof motors are not required.**
- **Easily removed** for seasonal use.
- For repair and replacement **only individual casings need to be removed** - not the entire cover.
- The LemTec Modular Cover System is only a **fraction of the cost** of conventional fiberglass and aluminum dome designs.

# Easy Installation On Either Ponds Or Tanks

- **Versatile:** can be installed with basin full or empty.
- Unlike other single sheet geomembrane covers, this product can be **installed with very few people and minimal equipment.**
- **Buoyancy** provided by rigid cover can **support several crew people.**
- **No field welding is necessary.** The cover is fabricated per specifications in a controlled environment to ensure quality welds.



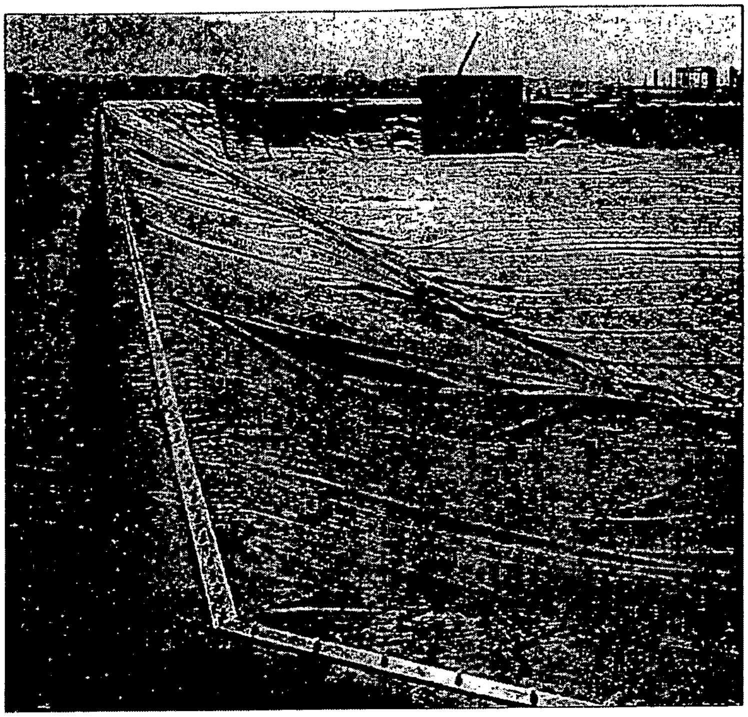
*LemTec Modular Cover prior to Gas Collection Cover*

*Installation of LemTec Modular Cover*

# LemTec™ Gas Collection System

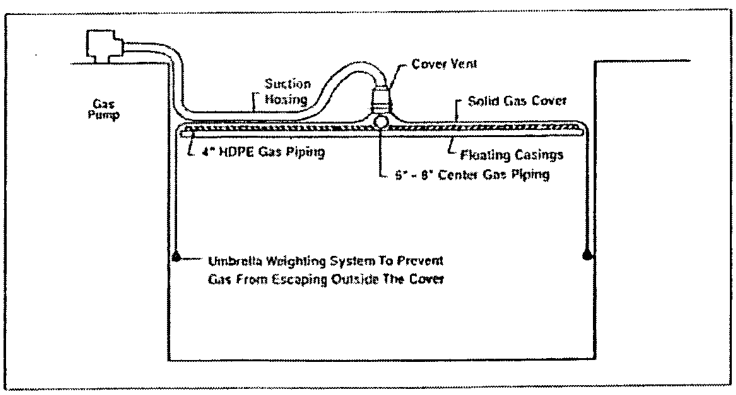
If gases from your pond or tank must be collected, use the **LemTec Gas Collection System.** The LemTec Gas Collection System consists of a single sheet of geomembrane installed over the modular cover to provide an airtight cap that traps and contains gases.

- While the standard modular cover provides insulation and floatation, **gases** are allowed to escape between the modular casing and **are contained** by the solid top sheet geomembrane.
- **Gas travels via the gas duct system,** consisting of a grid of 4" corrugated piping that is secured beneath the single sheet geomembrane. This creates an opening between the LemTec Modular Cover and the gas collection cover through which gas will travel.

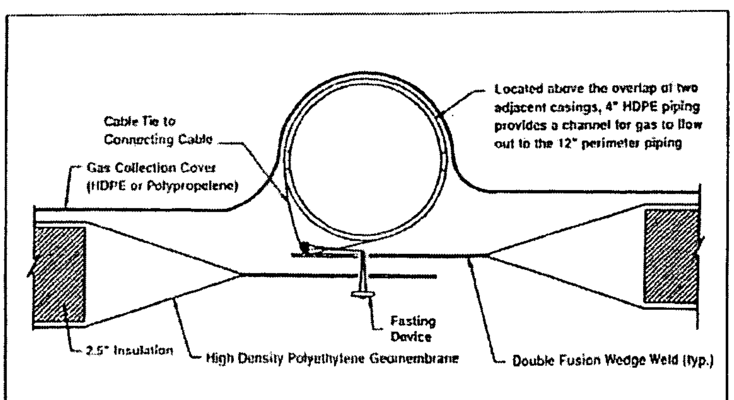


*LemTec Gas Collection System on 3 Acre Basin*

- Gases are then pumped off to either the perimeter or the center of the basin where they can be **flared off** or collected and **used for fuel.**
- **Gas ballooning is eliminated** because the path that the gases follow is larger than conventional geomembrane gas collection systems.
- Because the **modular cover creates a rigid foundation** under the LemTec Gas Collection System, **rips** and **abrasions** are **avoided** because there is no excessive movement or flexing of the cover.
- All LemTec Gas Collection Systems offer **supplemental insulation** to assist in maintaining basin temperature.
- **Competitively priced.**
- This simple addition to the LemTec Modular Cover provides **complete odor containment and gas collection with insulation R-factors from 8 to 25.**




*Example of LemTec Gas Collection Cover for Tanks*



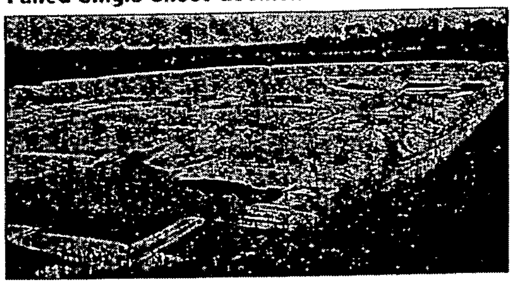

*Cross-Section of LemTec Gas Collection System*

# LemTec™ Modular Cover

## Compare The Advantages

## Problem

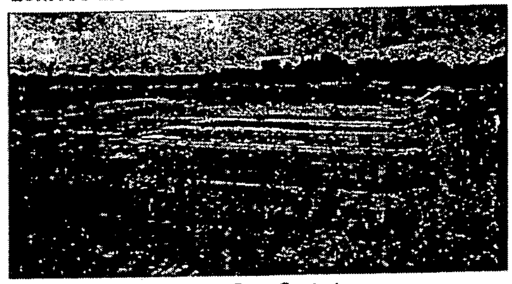
**Failed Single Sheet Geomembrane**



*Ballooning Problems*

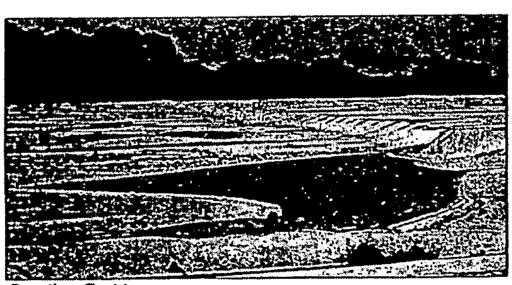
## Solution

**LemTec Modular Cover**

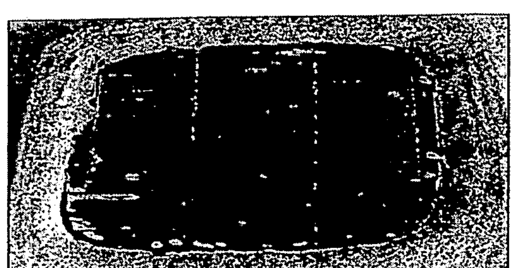


*Diary Farm for Algae and Odor Control*

| | Problem | Solution |
|---|---|---|
| **Rainwater** | • Must have rainwater collection systems | • Not required |
| **Rainwater Collection System** | • Easily fouled with debris creating ponding | • Unique design allows rainwater to pass between individual modules, eliminating pooling |
| **Ballooning** | • Minor gas creation will cause ballooning possibly damaging cover and rainwater collection system | • Gases allowed to escape between the casings |
| **Heat Retention** | • Typical single layer cover is poorly insulated | • All LemTec covers offer insulation from 8 to 25 R<br>• High density polystyrene encapsulated by two layers of geomembrane |
| **Varying Water Levels** | • Typically only limited variation of water levels | • Adapt to any variation in water level |
| **Installation** | • Expensive - requires large crew and heavy mechanical equipment<br>• Basin usually requires dewatering | • Less Expensive - requires 1/3 crew and no heavy mechanical equipment<br>• Basin can be full or empty |
| **Field Welding At Installation** | • Required<br>• Elements such as precipitation and temperature can effect integrity of weld | • No field welding required<br>• Fabricated in controlled environment to assure 100% quality welds |
| **Floatation** | • Little support and perilous to walk on | • High buoyancy and rigidity<br>• Can easily support several people |
| **Custom Hatches and Openings** | • Not able to accommodate surface equipment, walkways. . . etc. | • Built-in hatches for easy access to submerged equipment or for sampling<br>• Customized openings for any surface equipment |
| **Maintenance and Repair** | • Costly - large crew and heavy mechanical equipment is necessary | • Only individual casing needs to be removed<br>• Only two people required and no mechanical equipment |
| **Seasonal Use** | • Not practical because expensive to remove and replace | • Individual casings easily removed and re-installed as needed |



*Ponding Problems*

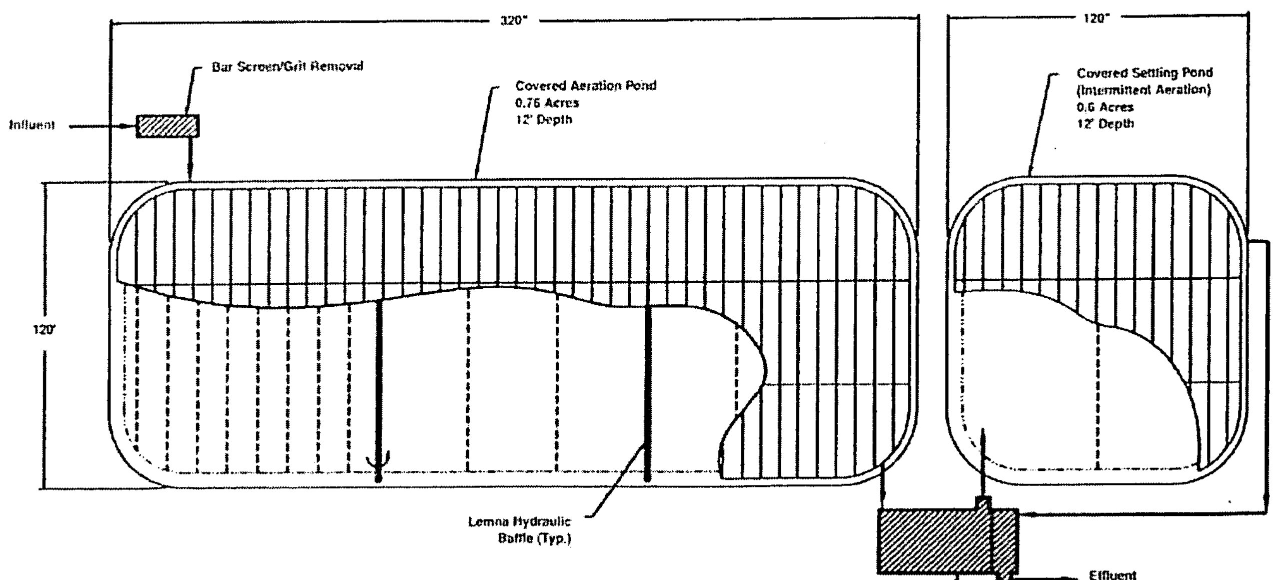


*Winter Application for Heat Retention*

# LemTec™ Biological Treatment Process

The LemTec Modular Cover is more than a lid for earthen or manufactured basins. When used as part of the **LemTec Biological Treatment Process**, performance in lagoon-based systems will dramatically improve to **meet the most stringent effluent limits.**

- The closed cell insulation design promotes process efficiency in colder climates by increasing operating temperatures to allow for **year-round nitrification** regardless of ambient air temperatures. Higher water temperatures also promote biological activity which results in **more efficient treatment.**
- Because the LemTec Process combines conventional mechanical treatment methods with the advantages of the modular cover, **detention times** are drastically **reduced** while **footprint** size can be **reduced by 70%** that of conventional lagoon designs.
- Existing treatment facilities faced with increasing flows can be **easily retrofitted** with the LemTec Process. This cost-effective solution will **allow expansion** of hydraulic flows by **as much as 300%.**
- The need for **storage ponds** in colder climates is **eliminated** by insulating the water column from influent to effluent, thus maintaining a temperature that will allow nitrification to occur.
- **Operation & maintenance costs** are the **lowest** of any high-quality effluent technology.
- An **activated sludge operator is not required.**
- With the pond being completely covered, sunlight cannot reach the surface of the water, thus **eliminating algae production.**
- Because of its simple design and low cost operation, the LemTec Biological Treatment Process offers an affordable and sustainable solution to wastewater management at typically a **lower cost** than methods such as oxidation ovals and other extended air activated sludge designs.




*Typical LemTec Biological Treatment Process*

# LEMNA

Lemna Technologies, Inc.
2445 Park Avenue
Minneapolis, MN 55404
Tel 612-253-2002 / Fax 612-253-2003
e-mail: techsales@lemna.com
Website: http://www.lemnatechnologies.com

# EXHIBIT 7

**PATENT**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

| | |
|---|---|
| In re Application of:<br>William D. Morgan et al. | Group Art Unit: 1723 |
| Serial No.: 10/003,037 | Examiner: Krishnan S. Menon |
| Filed: November 2, 2001 | Atty. Dkt. No.: IAEC:006US/MTG |
| For: COVERING SYSTEMS AND VENTING METHODS | |

**SECOND DECLARATION OF MICHAEL A. MORGAN**

I, Michael A. Morgan, declare as follows:

1. I am an inventor of the above-referenced patent application.

2. I am a founder and principle owner of Industrial & Environmental Concepts (IEC), and have been for 14 years. One of my main responsibilities during this period has been the design, from concept to installation, of floating covers systems for water treatment lagoons and tanks. Prior to founding IEC, I was employed with a geomembrane manufacturer. In total, I have 15 years of experience designing and building cover systems for wastewater-filled ponds. I received a BS in Civil & Environmental Engineering from the University of Wisconsin in 1989.

3. Reference C2 identified in the Information Disclosure Statement (IDS) filed on February 4, 2004 was available to the public more than one year prior to October 5, 2001.

4. The cover system shown in reference C4 identified in the IDS is only a partial representation of the full cover system. The full cover system of C4 is similar to the cover systems disclosed in the Gerber patent (U.S. Patent No. 4,503,988). It included a gas collection system for siphoning off gas that was collected under the cover. As a result, the C4 cover system was under negative pressure. If openings were formed in the C4 cover, that negative pressure

would be jeopardized, and the gas collection system could be rendered less effective or ineffective.

5. The perimeter of the C4 cover system was anchored around its perimeter so that gas would not escape around its outer edge.

6. The C4 cover system was used in public in the United States more than one year prior to October 5, 2001.

7. I have read and understand the Wilson patent (U.S. Patent No. 4,438,863). I also understand that the Patent Office is asserting that one of ordinary skill in this art would be motivated, in light of C2, to provide openings in Wilson's cover "because it would help drain the rain water collected down in to the pond and also work as a gas vent." I disagree with this assessment.

8. Wilson concerns a cover system for dirty water such as industrial sludge, food wastes, and the like. The cover system is designed to be gas tight inside of the perimeter sump where rainwater collects and is siphoned off. People of ordinary skill who deal with gas collection from dirty water systems (like Wilson) try to avoid increasing the volume of the dirty water. Thus, they would not want to provide openings in Wilson's cover through which rainwater could potentially drain into the dirty water pond.

9. Furthermore, they would not want to provide openings in the portion of Wilson's cover that is bounded by the rainwater sump. That portion of the cover is airtight and designed for gas collection, not gas release. Thus, people of ordinary skill in this art would not have any reason to create openings in that portion of Wilson's cover because doing so goes against Wilson's purpose.

10. All statements made of my own knowledge are true and all statements made on information are believed to be true, and statements in this document were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both under § 1001 of Title 18 of the United States Code.

3/22/05
Date

Michael A. Morgan

# EXHIBIT 8

**PATENT**

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

| | |
|---|---|
| In re Application of: William D. Morgan et al. | Group Art Unit: 1723 |
| Serial No.: 10/003,037 | Examiner: Krishnan S. Menon |
| Filed: November 2, 2001 | Atty. Dkt. No.: IAEC:006US/MTG |
| For: COVERING SYSTEMS AND VENTING METHODS | |

CERTIFICATE OF MAILING
37 C.F.R. § 1.8

I certify that this correspondence is being deposited with the U.S. Postal Service with sufficient postage as First Class Mail in an envelope addressed to: Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450, on the date below:

2/04/04 Mark T. Garrett

Date Mark T. Garrett

## DECLARATION OF MICHAEL A. MORGAN

I, Michael A. Morgan, declare as follows:

1. I am an inventor of the above-referenced patent application.

2. On October 5, 2000, I, William Morgan, Sean Gallant, and James Hughes of Industrial & Environmental Concepts, Inc. (IEC) demonstrated the device shown in Information Disclosure Statement references C5-C13 at IEC's facility in Lakeville, Minnesota. A total of eight employees of Lemna Corporation attended the demonstration. The demonstration took place inside IEC's warehouse, behind closed doors, and could not be viewed by anyone other than the twelve people attending.

3. I was able to speak with seven of the eight Lemna employees that attended the demonstration, and all of the individuals that I spoke with confirmed that, prior to November 2,

2000, they did not discuss the details of the device they saw with anyone who did not attend the demonstration.

4. All statements made of my own knowledge are true and all statements made on information are believed to be true, and statements in this document were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both under § 1001 of Title 18 of the United States Code.

1-23-04
Date

Michael A. Morgan

25364717.1